The Engineering and Mining Journal

VOL. LXXXVII. NEW YORK, MAY 15, 1909. NO. 20.

The Diamond Bearing Highlands of Bahia—I

No Eruptives in the Lavras Series, the Immediate Source of the Diamonds; Carbonados the Most Important Product. Dredging Possibilities

BY J. C. BRANNER*

It is doubtful whether there is anywhere in South America a region of so much economic importance and scientific interest, and which is at the same time so little known, as the interior of the State of Bahia. This is especially true of the portion of the State lying south and southeast of the Rio São Francisco and northwest of the city of Bahia a large part of which is known as the Chapada Diamantina, or the diamond-bearing highlands. Though I have for many years been fairly well acquainted with other portions of Brazil, it was only in the year 1907 that I undertook to see the region here referred to. The trip was made for the purpose of determining the sequence of the rocks, and of working out the general geologic structure with special reference to the distribution of the formations in which diamonds and carbonados are found.

LEDGES OF PINK QUARTZITE NEAR LENCOES

From these the earth and soil have been scraped by miners in search of diamonds and carbonados. After being washed the coarse materials are piled on the flat bare surfaces.

THE RIDGE OF DIAMOND-BEARING PINK QUARTZITE

North of Andarahy, the rocks are false bedded, jointed, and sometimes faulted. The earth has been cleared out and the loose small stones are left piled on the larger ones.

OLD DIAMOND WASHING AT MOSQUITOS, NEAR LENCOES

Showing the white shales that underlie a diamond-bearing bed. The gulleys in the foreground were formed since the washings were abandoned.

A TRAIL ACROSS THE SALITRE VALLEY THROUGH A CHARACTERISTIC CATINGA FOREST

Transportation and Climatic Conditions

This part of the interior of Brazil is best reached from the port and city of Bahia. Two railways approach it, but neither of them penetrates it. The Bahia & São Francisco railway runs from the city of Bahia to Joazeiro on the upper São Francisco by way of Alagoinhas, Queimadas and Villa Nova, a distance of 574 km. On this line there is at present a change of gage at Alagoinhas. In order to reach the region under consideration from this line, one may either take a boat up the São Francisco, and then travel southward on mule-back, or he can leave the railway at Queimadas or Villa Nova and make the rest of the trip with mules.

Another route is by rail from Cachoeira, just north of Bahia, to Bandeira de Mello,

*Professor of geology, Stanford University, California.

which is 254 km. nearly due west of Cachoeira. Beyond Bandeira de Mello, however, travel is only by mules.

The region here considered covers an area of about 200,000 sq.km. It is mostly in the semi-arid region of the interior, a region that is fairly well watered along the streams, but in other parts is subject to occasional serious drouths. There are forests in the well watered portions and some *campos* in the elevated regions, but the greater part of the region is covered by a scrubby, stunted growth of timber, called *catinga*, that can be penetrated off the trails only by laborious chopping every step of one's way through cacti, thorns and vines.

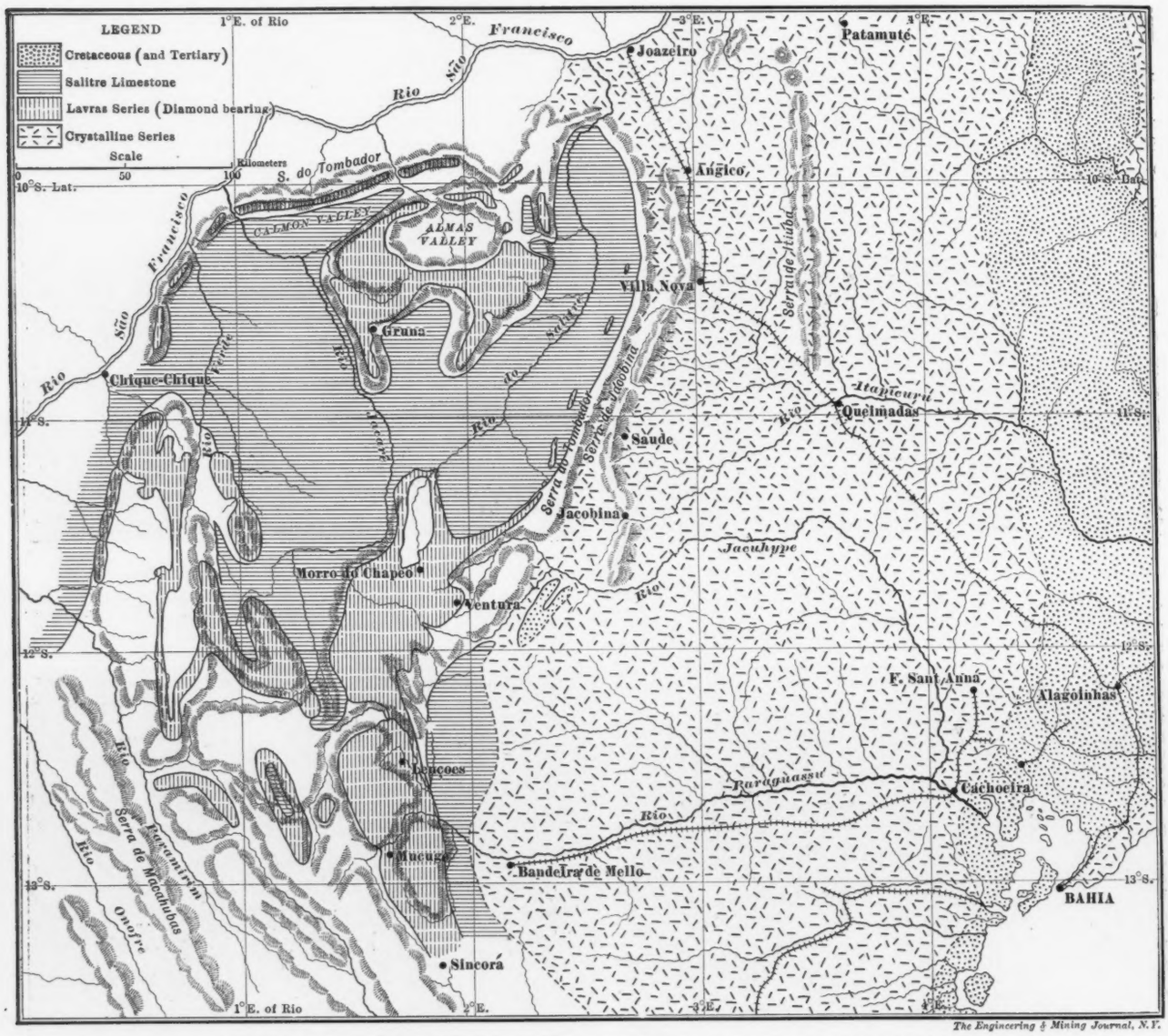
In the main the climate of this entire region, though hot, is as fine and healthful as can be found in any part of the world. This is especially true of the elevated *catinga* covered portions of the interior. Along the São Francisco and portions of Rio Salitre and Paraguassú there is some malaria at certain seasons of the year.

Outline of the Geology

The following brief sketch of the geology of the region will enable the reader the better to understand the distribution of its geologic products: Along the coast is a zone of Cretaceous and Tertiary sediments, somewhat folded and faulted, resting upon a series of old crystalline rocks that are exposed at and about the city of Bahia, and at a few other places on the coast. This sedimentary zone varies greatly in width; in some places it is wanting, while at others it extends far inland.

The most noteworthy development of these sediments in this state extends from the city of Bahia to Alagoinhas, and from that place northward to the Rio São Francisco just above the falls of Paulo Affonso. North of that stream this series is represented by isolated hills and outliers to the frontier of Ceará where they form the Serra do Araripe, the mountains to the southwest of these along the frontier between Bahia and Piauhy, and the general table lands of the State of Piauhy. A part of this Cretaceous belt is shown along the eastern margin of the accompanying map.

The rocks that appear to be the oldest in this portion of Brazil are schists, gneisses, granites and various other eruptives and metamorphics. This old series of rocks covers a broad belt between the Cretaceous and Tertiary sediments near the coast and the highlands of the interior. Over most of this region of crystalline rocks the country is a nearly level plain with an elevation of from 150 to 300 m., and broken by occasional steep-sided and fantastic peaks that rise abruptly from the *catinga* forests. There are a few mountain ranges of granite, the most noteworthy of which is the Serra de Itiuba north of Queimadas, but most of the peaks



The Engineering & Mining Journal, N.Y.

GEOLOGICAL SKETCH MAP OF THE CHAPADA DIAMANTINA OF THE STATE OF BAHIA, BRAZIL

and sharp ridges examined are of quartzite whose beds stand nearly or quite on end, while the country on both sides is of granites, gneisses, schists and old eruptives.

The Jacobina Range

The Serra de Jacobina is the most prominent mountain range of the region. Its southern end is about 30 km. south of the city of Jacobina, and it runs nearly north past Jacobina, Saude and Villa Nova, and at this last place it swings slightly westward and disappears on the plains south of the Rio São Francisco about 50 km. south of Joazeiro. The rocks of the Jacobina range are conglomerates, shales, talcose schists, and quartzites of the kind commonly known as itacolumites The beds are highly tilted, often on end, and throughout the entire length of the mountain range, when not on end, they have a high east dip, and the same strike as the mountain range itself. It is to be noted that this great range has the crystalline rocks on both sides of it. Lithologically this series of rocks resembles closely what was formerly known as the itacolumite series of Minas, but has lately been called by Derby the Minas series.

The Tombador Range

West of Jacobina is the great Tombador range of mountains that rises like a vast vertical wall formed by the edges of a series of nearly horizontal sandstones and quartzites that rest directly upon the old crystalline series. The Tombador beds here dip gently westward beneath the Salitre valley, and can be traced northward by their bold topography to the vicinity of the Rio São Francisco, where they cap the flat-topped mountains or form the monoclinal ridges that characterize the topography of that region.

Above the Tombador sandstones is a series of flinty beds that I have called the Jacuipe flints, and these are followed in ascending order by a great series of gray, red, yellow, black and cream-colored shales that form the surface rocks over large areas. In some places these shales closely resemble the Devonian shales of central New York, in others they are more nearly like the Mauch Chunk red shales of Pennsylvania. They have a total thickness of about 500 meters. This series is named Caboclo, from Serra do Caboclo on the Ingazeira estate on the west side of the Salitre valley.

HEAVY QUARTZITIC CONGLOMERATES

Part of the diamond-bearing series, Pedra Pintada, west side of Salitre valley.

The Diamond Bearing Lavras Series

Next above the Caboclo shales is a series of false-bedded pinkish sandstones, conglomerates and quartzites the upper part of which is called by Derby the Lavras series. These beds have an approximate thickness of about 700 meters. The diamonds and carbonados are from this series. In connection with the geology of the diamonds and carbonados it is of the utmost importance to know the upper and lower limits of the series yielding these stones. Fortunately the Caboclo shales that underlie the diamond-bearing beds are clearly defined and readily distinguished.

Above the Lavras beds is a series of red sandstones very like the Triassic red sandstones of New Jersey and Connecticut, and I have called them the Estancia red beds. These are in turn overlaid by the Salitre limestones which cover a large area in the interior of Bahia. The rocks of later age in the State of Bahia are not so well developed in the diamond region, and need not be mentioned here.

Section of the Chapada Diamantina

The accompanying section gives a resumé of the rocks of the Chapada Diamantina with the names of the series and their estimated thickness:

Names.	Thickness in Meters.	Ages?
Salitre limestones and marbles	350	Jura.
Estancia red beds	350	Trias.
Lavras series	700	Carboniferous.
Cambao quartzites	100	
Caboclo shales	500	Devonian.
Jacuipe flints	100	
Tombador quartzites	400	Silurian.
Minas series	1000	Cambrian.
Crystalline		Pre-Cambrian (in part).

CHARACTERISTIC FRETWORK WEATHERING

The diamond-bearing quartzites, Pico Annibal, east of the Almas valley.

CHARACTERISTIC FALSE BEDDING

The diamond-bearing quartzite at Sitio Retiro, on Rio Ingazeira, west side of the Salitre valley.

It should be distinctly understood that the ages assigned these various series are hypothetical, and based solely upon lithologic characters and physical breaks. Diligent search has been made for fossils, but nothing has thus far been found in the entire section here given. Within the area represented on the accompanying map the Cretaceous rocks about Bahia and extending north from that place are

the oldest ones in which fossils have yet been found. The uncertainty regarding the precise ages of the various series, however, does not affect the validity of the divisions or of their sequence.

Diamonds and Carbonados

Diamonds and carbonados are here treated together because they are found together in this particular field and in this field only. The most important existing mining industry of Bahia is that of diamond washing, including both the ordinary diamonds of commerce and the carbonados or black diamonds. Ordinary diamonds have been mined in the Chapada Velha, state of Bahia, since about 1830.

WASHING FOR DIAMONDS AND GOLD ON THE RIO ITAPICURU BELOW QUEIMADAS

They were discovered in September, 1844, on the Rio Mucujé at the spot where the city of São João do Paraguassú now stands, and a little later they were found about Andarahy and Lençoes. Up to about 1856 carbonados were not supposed to have any value, and no effort was made to save them; since that time they have had a market value, and now they are the chief object of mining operations throughout the diamond district.[1]

Heretofore it has not been possible to state the area of the diamond-bearing rocks, chiefly because the geology of the region was not known. The first, and indeed the only geologic study hitherto made of the Bahia diamond district was one by Prof. O. A. Derby,[2] who spent a week or two in the region about Lençoes in the year 1905. The region supposed to yield diamonds has been variously estimated, and is usually made to include enormous areas of the overlying limestone or of underlying formations, while extensive tracts have been overlooked because no one knew the distribution of the rocks in which the diamonds are found. The studies made by me during the year 1907 have made it possible to outline for the first time the geology of the diamond region of Bahia and to determine the distribution of the diamond-bearing beds.

Referring to the geologic sequence of the rocks given above it will be seen that the Lavras series of rocks is made up of conglomerates, sandstones and quartzites that have a thickness of about 700 meters, are provisionally referred to the Carboniferous. These rocks are of a marked pinkish color, except where they have long been exposed to the weather when they commonly, though not always, become white. They are strongly and almost universally false-bedded, and are often covered with fretwork on weathered surfaces.

The Pink Lavras Quartzite

A sample of the typical pink quartzite was taken in the midst of the diamond washings between Lençoes and Andarahy and an analysis, made by L. R. Lenox, gave the following results: Silica (SiO_2), 97.94 per cent.; oxides of iron and alumina (Fe_2O_3 and Al_2O_3), 1.98; lime (CaO), none; magnesia (MgO), trace; total, 99.92. The composition is about what one would expect from an examination of the rock. The pinkish color is due, no doubt, to the small percentage of iron which is very evenly distributed through the rock.

Though it is here confidently stated that both the diamonds and carbonados come from this series of rocks, the writer has never seen either a diamond or a carbonado in place in any of them. The washings, however, are always along streams that flow in or over these beds, or at the edges of them, where the detrital and residuary materials gravitate to the streams, and are there concentrated. Over a large part of the slopes of hills and mountains where the beds of this pink Lavras series form the surface rocks, the diamond washers have scraped and gathered the disintegrated rock from every crevice and cranny with the utmost care, and in this material the diamonds and carbonados are found.

In the valley north of the town of Andarahy one can hardly find a spoonful of disintegrated rock in place today, so carefully has it been removed by the diamond washers. One of the accompanying photographs shows how the small stones are pulled out and piled on top of the large ones in this search for the decomposed sandstone. Inasmuch as the pinkish Lavras quartzite is the top rock through most of the diamond region, this habit of the experienced miners is accepted as evidence that it is from these quartzites that the diamonds are derived.

Immediate Source of the Diamonds

In the elevated region in the vicinity of Morro do Chapeo the rocks of the Lavras series are the highest beds, and they are but slightly folded. There the streams rise in and flow for miles in the pinkish quartzites, and the diamonds and carbonados are taken from the beds of these streams. Many similar illustrations might be mentioned, but these are sufficient to show that there is no question about the immediate source of the diamonds in this district. Cases of diamonds in place in these quartzites have been reported to the writer, but though he has never personally seen such specimens, the geologic evidence is all in favor of the theory that the diamonds and carbonados come directly from the Lavras beds.

WAYS AND MEANS

Travel in the interior is mostly on mule back, and the roads are trails.

At the town of Ventura the diamonds are found in a deep gulch sunk in the Caboclo shales, and several hundred meters below the Lavras series. The diamond-bearing beds, however, cap the hills on one side of the gulch, while the stream that flows through that gulch is fed by many branches that rise on the high plateau of the Lavras rocks to the north and west.

One may also hear occasionally of dia-

[1] The carbonados are commonly known as carbons or black diamonds. The following articles give information regarding the carbonado business. H. W. Furness in *U. S. Consular Reports*, LXX, 96-97, Washington, 1902; same volume, pages 145-154; same author in *Popular Science Monthly*, LXIX, 272-280, New York, September, 1906.

[2] O. A. Derby. "The Geology of the Diamond and Carbonado Washings of Bahia, Brazil." *Economic Geology*, I, 134-142; the same in *Smithsonian Report* for 1906, pp. 215-221. Washington, 1907.

monds found in the region east of the area of the Lavras beds. The miners commonly speak of these stones as river diamonds, for they are usually or always along streams that flow from the diamond bearing rocks, and it is understood that they have been carried down by the streams from the diamond region proper.

In 1898-9 diamonds and gold were found on Rio Itapicurú about 40 km. below the town of Queimadas. Diamond washing was carried on in a desultory way from the Fazenda Conceição to Fazenda Boa Vista, a distance of 65 km. down the river. Not enough is now known of the details of the geology of that part of the State to be sure whether the diamonds found there come from an infolded or infaulted portion of the Lavras beds, from the removal of the Cretaceous sediments, or from some other independent source.

CARIMBE AND BATEA

When earth has to be moved, it is carried on the head in shallow wooden bowls called carimbés. Washing for diamonds is done in bateas—large, deep, wooden bowls. The one on the man's head is a carimbé; the one on the ground is a batea.

Absence of Eruptive Rocks

It should be added that no eruptive rocks occur in connection with the diamond- and carbonado-bearing rocks over the greater part of the district. That is, the diamonds cannot be attributed to the influence of eruptive rocks on the beds in which they are now found. Some basic dikes are said to traverse the Lavras beds and the overlying Estancia beds and the Salitre limestones both east and west of the Serra do André, but these reports require confirmation. But in no case can such dikes have anything to do with the occurrence of diamonds hundreds of kilometers away and over the region as a whole.

Among the crystalline rocks that underlie the sedimentary rocks of the diamond region the writer has found a considerable area of serpentine that suggests the possibility of the diamonds having originated in peridotites of the old crystalline series and having been passed down to their present position in the Lavras beds through several geologic generations.

Once the diamond-bearing formation and its stratigraphic relations are recognized, the areal distribution of the diamonds is readily determined in the field. This is due partly to the simplicity of the geologic structure, and partly to the marked contrast between the rocks of the Lavras series and those both above and below them. Over most of the region the beds are gently folded and remind the geologist of the region of folded rocks in the anthracite region of northeastern Pennsylvania. About Morro do Chapeo the folds are quite gentle but north of there, and especially in the mountains west of Gruna, the folds are closely pressed and merge into faults. In other places there are faults that have let the diamond bearing beds down until one edge is carried far below the underlying Caboclo shales. The accompanying section across the Almas valley will give an idea of the general geology of that part of the diamond region.

WASHING FOR DIAMONDS AND CARBONADOS IN THE BAHIA REGION.
From a photograph.

Rock Structure Near Alagoinhas

The structure in the vicinity of the village of Alagoinhas of Jacobina Nova is shown in the north-south section across Riacho da Boa Sorte. At this place the Lavras beds were limited on one side by a fault and on the other by the base of the series. It was thus surrounded by the underlying shales. Often the outcrop follows for many miles along the side of a mountain range, rising here and there to its crest. Again these beds form outliers, or they cap outliers made up mostly of the underlying formations.

These instances are sufficient to show the nature of the geologic problems connected with the diamond-bearing rocks. As is to be expected in such structure the area over which the diamond bearing rocks are exposed is not one single compact area, but a number of irregular areas separated by the denudation of anticlinal folds, by the burial of the synclines beneath later deposits, by faulting, or by the overlapping of later deposits. In some cases the diamond-bearing beds outcrop along narrow zones for long distances; in others they widen out over areas covering hundreds of square miles, and in still others they are mere remnants of the original beds. The accompanying map is necessarily on too small a scale to attempt to give more than a general idea of the distribution of the rocks of the Lavras series. The details, however, are readily worked out on the ground.

Productive Area Between Sincora and Morro do Chapeo

The region that has thus far produced most of the diamonds and carbonados lies between Sincora on the south and Morro do Chapeo on the north. The reason for the productiveness of this particular belt is not certainly known at present. It may be due to the greater richness of the rocks, or it may be due to the fact that it is only here that there is an abundance of water for hydraulic mining. Outside of this better worked zone water is either altogether wanting or it can be had only during the rainy season of the year, which is usually very short, and sometimes fails altogether.

WASHING FOR DIAMONDS AND CARBONADOS IN THE BAHIA REGION
From a photograph.

It is also worthy of note that, except locally, the diamonds and carbonados are not exclusively confined to any particular part of the Lavras series. About Morro do Chapeo, for example, they come from one part of the series, and about Lençoes and Andarahy from another. One of the accompanying photographs, made at Mosquitos, shows a sharp line of demarcation between beds in the Lavras series that are productive above and barren below.

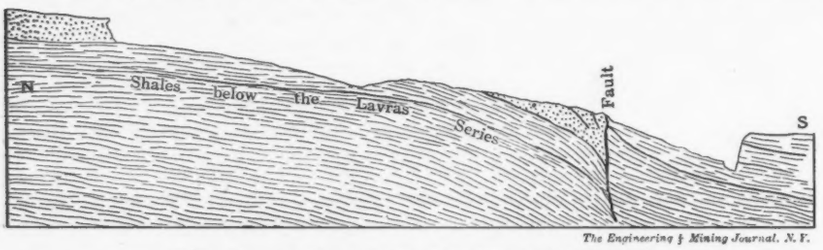
Mining Methods

The mining methods used in the search for diamonds are mostly of the rudest possible kinds. The work is all done by hand, and there is practically no machinery used in the district with the exception of a small electric plant and a little miscellaneous machinery belonging to one foreign company near Lençoes.

The Brazilian method of washing the diamond-bearing gravel was first described by John Mawe in his "Travels in the Interior of Brazil" published at London in 1812.[1] It is interesting to note that the methods described by Mawe a hundred years ago are still in use in Brazil wherever diamond mining is done on a considerable scale and are, indeed, the only ones thus far employed in the diamond regions of South America. When operations are on a small scale, the methods are modified to meet the requirements. The soils and gravels are concentrated by various crude processes, which consist of stirring the materials in the bottom of a stream, or by dashing water against a pile of gravel while it is being stirred. The final "clean-up" is made in large wooden bateas or bowls, the diamond washer standing in the water as shown in the accompanying drawings which are made from photographs.

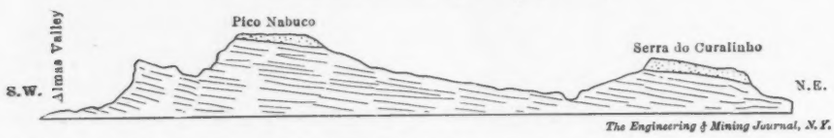
NORTHWEST-SOUTHEAST SECTION FROM RIO SAO FRANCISCO TO THE SALITRE VALLEY

Showing the general geologic structure of the region for a distance of about 160 kilometers.



NORTH-SOUTH SECTION ACROSS RIACHO DA BOA SORTE

Sitio Cachoeirinha near the village of Alagoinhas, showing the diamond bearing beds let down into the underlying shales by a fault.



SECTION THROUGH PICO NABUCO, SHOWING THE DIAMOND-BEARING BEDS AT THE SUMMIT AND THE CABOCLO SHALES BELOW

Hand vs. Mechanical Exploitation

The question naturally arises whether with modern mechanical appliances and mining methods, the mining for diamonds and carbonados could not be made much more lucrative than it is at present. This question, however, cannot be answered with a simple yes or no. Diamond washing is a peculiar business in this respect, that the values are so concentrated that the element of personal honesty of the employees is a matter of the utmost importance. A single diamond worth thousands of dollars may be found, secreted, and carried away by a diamond washer, even when closely watched.

Under the system now in vogue this risk is not important, or rather it is seldom taken, because there are no large companies employing many diamond washers. The work is chiefly in the hands of individuals working independently. A man who leases a piece of diamond-bearing ground may employ helpers to make ditches, to do digging, to remove earth, or boulders, or to help in any way that may be necessary, but when it comes to the washing of the gravels or the final "clean-up," that work is usually done by the holder of the lease alone, or by some one in whom he has perfect confidence.

Another point about machinery is that over much of the diamond-bearing ground the amount of material to be washed is too small to warrant its instalment and the frequent removals that these small deposits would entail.

Possibilities of Dredging Swamp Land

On the other hand, there are places where the local conditions suggest that machinery might be used to great advantage. For example, at certain places the topography is such that there are extensive tracts right alongside of rich diamond-bearing ground permanently buried beneath swamps that cannot be drained. The native workmen have worked the ground right down to the edges of these swamps, but being unable to shut off the water, they have never been able to get at what is probably the richest of the deposits. It naturally occurs to one that some adaptation of modern gold dredges could be used to advantage in these low grounds.

Another point that is probably in favor of the dredging of these marshes is that during the first 12 years of diamond mining in the Lençoes district the carbonados were not known to have any value. According to official statistics those 12 years were among the most productive in the history of the region. And during that entire period the carbonados were thrown aside with the tailings and were of necessity washed with other waste into the swamps from which they could not be recovered by any methods with which the native diamond miners are familiar.

The objection to dredges in such a place are: (1) The difficulty of transporting the heavy pieces; (2) that one is here a long way from the factory and from repair shops. However, there are railway repair shops at Cachoeira, Bahia, and Alagoinhas, where all ordinary repairs can be made. The transportation of the large and heavy pieces of a dredge beyond the end of the railway can be obviated partly by the use of boats on the Paraguassú river above the end of the railway at Bandeira de Mello, and partly by opening wagon roads over the rest of the distance. It is also highly probable that the railway will soon be extended considerably beyond its present terminal station.

At the end of this article something will be given concerning the mining laws of the state and the conditions under which the diamond lands can be worked.

(To be continued.)

[1] An American edition of this book was published at Philadelphia in 1816. The process of washing diamonds is described at pp. 230-232 of the American edition.

Tonopah Mining Company of Nevada

During the year ending Feb. 28, 1909, 234,017 wet tons were hoisted from the Mizpah, Silver Top and Red Plume shafts, of which 155,401 dry tons of ore averaging $23.43 per ton, were shipped to the mill at Millers; 7957 tons were placed in storage at Millers for emergency use; 13,635 tons of low-grade ore were placed on the dump, and 50,296 tons of waste rock were hoisted. Mining cost per dry ton of ore shipped, including cost of sinking shaft, diamond drilling and station, was $4.80.

There were milled and treated 158,052 dry tons of ore averaging 0.354 oz. gold and 31.13 oz. silver per ton, making the total metal contents 55,884 oz. gold and 4,940,464 oz. silver. The average recovery of both gold and silver was 90.3 per cent. The total milling cost per dry ton of ore was $4.165. Upon comparison with the previous year, this indicates a reduction of $1.746 per ton in the cost of milling. The dividends amounted to $750,000.

Silver-Lead Mining in Freiberg, Germany

Mining Began in the 12th and Reached Its Zenith in the 19th Century; Academy Founded 1766. Four Types of Veins; By-products Important

BY WILTON G. BROWN*

Freiberg in Saxony has always been full of interest to the geologist on account of its famous examples of "gang structure." Just now, however, a peculiar interest attaches to the place, owing to the announcement of the King of Saxony that he will soon close the Freiberg silver mines which have worked continuously for 750 years. These Saxon mines with one exception are owned and operated by the government, and for the last few years have been worked at a heavy loss. This fact, of course, accounts for the edict which sets 1912 as the date for closing.

Geology

The Freiberg district lies on the long northwest slope of the Erzgebirge at an elevation of about 1300 ft. The surface has been cut into something of a basin by the Freiberger-Mulda river. From the Freiberg district to the north and east stretches a vast alluvial plain which in some places has a depth of more than 1000 ft. Structurally, the section is a dome of which Freiberg is about the central point. The country is biotite-gneiss. The movement which pushed up the dome is also responsible for the metamorphism of the older biotite-granite into the present Freiberg gneiss. Underneath this dome of gneiss lies a stock or batholith of later granite which was probably forced up during the same disturbance which formed the dome. Dikes of mica-syenite, mica-diorite and quartz porphyry are also found cutting the gneiss. These dikes are probably Upper Carboniferous; they are not mineralized and are older than the ore veins.

The Freiberg veins are classified as follows: (1) High-grade quartz veins; (2) Silicious lead veins; (3) High-grade lead and iron carbonate veins; (4) Barite, lead and silver veins. Of these types the first is the oldest and the last the youngest. There are two sets which follow the fault planes in the gneiss of the dome, one running about northeasterly and the other northwesterly. The veins in the granite stock do not carry ores, and this of course suggests a deeper source—an idea which is further supported by the wide extent of the ores. Probably the most extensive vein in the whole district is the "Hohe Birke" (high birch), which has been mined for a distance of four miles and to a depth of 1500 ft. The ores remaining are, for the most part, silicious and must be concentrated. Bunches of high-grade ore are broken down on canvas, packed in sacks and sent directly to the smelting furnace.

Early History

Mining was undertaken in Freiberg about the time of the third crusade, 200 years before the fall of the Eastern Roman Empire, and 300 years before Columbus set out on his voyage of discovery. In 1162 a salt miner from Gosslar brought a load of salt cross-country to Bohemia. One day he picked up in the road a chunk of lead ore seamed with silver. This was a little later the site of one of the best producing mines of Freiberg. News of his discovery spread through the Harz mountains on his return, and, when a little later, there was trouble in the Harz mines, many miners went to the new Saxon fields.

"Otto the Rich," then Margrave of Saxony, went into the mining business when silver was found. Leases were made on the basis of "ten per cent. of smelter returns," with the additional proviso that the Margrave could buy all the silver output of the smelters. Having thrown all the burden of operating on others, Otto wanted all possible revenue and so threw open the district to prospectors. This gave to the town its name Frei Berg. By the middle of the 13th century mining in the district had assumed such importance that the government mint was located at Freiberg.

Crude Methods

In the early days mining methods were primitive and consisted chiefly in "gophering" for streaks of native silver. A large mine employed perhaps 8 or 10 men, and nearly every mine had its own little smelter. The mines were operated for 400 years before the introduction of pumps, and for 500 years they worked without powder. Many miles of workings were driven with only hammer and wedge. When the ground became too solid a fire was built at the face to fissure the rock a little and to permit the wedge to enter.

Era of Greatest Production

The zenith of mining came in the third quarter of the 19th century. During that period as many as 9000 men were employed. Production of both mines and plants was crowded to its utmost. At the present time mining has dwindled until only about 2000 men are employed, and out of more than a score of properties which were working here a few years ago only two government mines and one independent mine are operating. This independent mine is being operated on a more economical basis than the government properties, and as a result shows profit. It will not be closed with the government mines. The term mine as used here means a group of mines which have more or less connected workings. Thus, for example, "Himmelfahrt" mine has five separate shafts and plants, each of which would be termed a mine in America. The separate groups are so far connected that one may travel in underground galleries almost from one end of the district to the other. Masonry or brick arches take the place of timber in the upper workings and old railroad rails serve for stulls in the recent portions. Very little timber is used.

The names given to the mines echo the strong religious tendencies of Saxony. Translating typical names, they read as follows: "God with us," "Help of God," "Christ's Gift," "Heaven's Ruler," "Road to Heaven." Further evidence of the religious tendencies is the fact that miners are compelled to attend chapel exercises each morning before going to work. So the miner attends morning prayer at 4:40 in the morning, goes on shift at 5 and is off shift at 3 o'clock in the afternoon.

Practically the only advance made during the 15th century was the adaptation of water wheels to hoisting. Once introduced, these rapidly came into general use. The 16th century saw the beginning of systematic work. Pumps were installed. A drop in the price of silver gave mining a bad setback in the first part of the 17th century. For the first time blasting was attempted. The 18th century was marked by scientific progress. The nine operating smelters were combined to form only three. All mining equipment was increased, bettered, and great improvement made in blasting practice. As an expression of increasing scientific interest, the Freiberg Mining Academy was founded in the year 1766. The practical benefits of this school were twofold: (1) Its professors made, in laboratory and field, the most careful and detailed study of veins, ores and

*Mining geologist, Helena, Mont.

minerals. (2) Its graduates were technical men fitted to direct mining operations.

In the 19th century there was considerable hardship over the matter of power. In 1844 the government began work on the "Rothschönberger" drain, finishing it some 30 years later. This tunnel drains all mines in the district to a depth of 1800 ft. and with all its branches has a length of almost 30 miles. The completion of the railroad at about the same time cheapened fuel and transportation, also making it possible to smelt foreign ores.

The total production of silver in the district is 6,500,000 kg., valued at $230,000,000. I have been unable to find any tabulation of lead production in the Freiberg district or of the value of its by-products handled in more recent years. Of course these items count up rapidly as savings, but do not begin to offset the drop in the price of silver. The lead ores here are not massive enough to have any great importance for their lead contents, especially when lead is as cheap as it is today.

Operations in 1908

In 1908 the King of Saxony lost something over $200,000 on the Freiberg mines. This was due in large measure to the low price of silver, but it was even more due to the condition of the mines. They are now over 2000 ft. deep, and even under favorable conditions it is expensive to operate at this depth. It is worse, however, when operating with old machinery, old miners, and by hand work. Add to this the fact that the Freiberg veins are narrow, and it is not surprising that there is a loss. Miners here receive only 50 to 75c. per day, but judging from what I saw, it is about all they are worth. The men themselves are mostly old, without energy, and do little work; at any rate, cheap labor is not economical when the mechanical operating expense is large.

A private company in Frankfort recently offered to buy the Freiberg smelters and mines from the government, including both those operating and those already shut down. The king agreed to make the sale if the purchasing company would agree to keep all the old employees. This was promptly refused, however. It is possible that some agreement may yet be reached with this company.

In the Freiberg district we have opportunity to compare private and state ownership of mines. Each seems to have its advantages. Of all the private mines only one is still operating, and yet it is making a margin of profit, while the government has been working its mines at a heavy loss for some years. No official is going to scrutinize his expense or labor bills quite as carefully as the man who must foot them. There is no doubt that the government has put through large projects and has made its different mines work together better than private companies could have done. Yet, so far as actual operating expense is concerned, the balance seems to lie with the private properties.

Concentration, Smelting and Refining

Concentration here is similar to American practice in most points, although the machinery is of different pattern. From the crusher the ore passes through Cornish rolls and all coarse material goes to jigs. The fine stuff is handled on tables which are between a Wilfley table and a vanner in that they have a traveling rubber belt, an end motion, and a side discharge like a table. The coarse concentrates are reduced by dry stamping to about 20 mesh before going to the smelter. Two smelters are in operation in Freiberg, and while these will not be closed with the mines it is likely that they may be combined into one plant. The bulk of their ore supply comes from Freiberg, but they receive much from other Saxon districts, and in fact from all over the world. One sees in the bins ores from South Africa, Australia, South America and even from Japan.

After sampling the ore takes one of four channels according to its nature: (1) That with 25 per cent. or more sulphur goes to the sulphur plant. (2) That with 28 per cent. zinc to the zinc plant. (3) That with 10 per cent. arsenic to the arsenic plant. (4) All other ores to the roaster or furnace of the lead smelter. All tails from the first three processes also go to the lead furnace. In the sulphur plant there are three types of roaster: (a) "Kiesofen," for egg-size ore, (b) three-stage "muffle ofen" for nut size, (c) "schüttröstofen" for dried concentrates. This last type is really a stack containing many little platforms to tumble the material over and check its fall. The gas from these various roasters comes together into a central canal and goes to the lead chambers, where it is thrown down with steam and oxidized with nitric acid in the old-fashioned way. The waste gases from this plant go to the bag-houses and pass out with the fumes from the smelter. The six lead chambers have each over 3000 cu.yd. contents and when working full the capacity of the plant is 20 tons of sulphuric acid daily. Some of the acid is shipped crude for use in different factories, some is concentrated and refined on the ground, and still another part is placed in large vats with scrap iron to make iron sulphate for tanning and fertilizer. Permission to visit the acid-refining room is given only grudgingly since one of the big $16,000 platinum dishes was stolen last year.

At the zinc plant, zinc is distilled with coal and recovered as in Joplin. At present there are not enough zinc ores coming in to keep this plant in operation. The arsenic is recovered and refined by a secret process which is not open to inspection. The roaster and "hochofen" of the lead plant are similar to the American reverberatory roaster and lead furnace, but are operated somewhat differently. Both oxide and sulphide ores go through the reverberatory, and the charge is brought to such a heat that it fuses into a mass of matte, which is broken up for the furnace. The furnaces have no "lead well" and the bullion being drawn off direct is consequently dirty and mixed with matte. It must then go through a cleaning furnace before being cast into bars.

Refining is first done by crystallizing the lead through a series of kettles. Bullion from the lead end is then reheated and further cleaned with zinc before going out as pig lead. The silver bullion from the kettles carries about 2½ per cent. in silver and is further put through two oxidizing furnaces. The first of these turns out 70 per cent. fine silver, and the second removes the last of the lead as well as bismuth. The bismuth is recovered and refined. The refined silver is then granulated and electrolized to recover the gold and platinum.

The royal mint is connected with the smelter and only a mile or so distant are the royal lead factory and shot tower. The ores are mined, concentrated, smelted, refined and the metals used in Freiberg. The precious metals are stamped into coin and the lead manufactured into wares; the sulphur is made into acid ready for use in the arts or further converted into fertilizer; the arsenic is turned into commercial oxide; the platinum, bismuth, antimony and zinc are turned out in metallic form.

Experiments show that wire from Monell metal, rolled, annealed and cold drawn, has a tensile strength of 110,000 lb. per sq.in., the elastic limit being 80,000 lb. The metal is an alloy containing approximately 70 per cent. nickel, 30 copper, with a little iron and manganese. The Orford Copper Company has granted the sole right to make wire from this metal to the Driver-Harris Wire Company, of Newark, N. J. The metal is made from Canadian nickel-copper matte.

In 1908 the production of garnet in the United States, as shown by figures collected for The Mineral Industry, amounted to 2530 short tons only, valued at $78,090. In 1907 the production was 6723 short tons with a value of $209,895. The increasing use of artificial abrasives apparently restricted the production of garnet which is used as an abrasive in the manufacture of boots and shoes.

The New Oilfield in Utah

By A. P. Rogers*

The southeastern part of Utah is one of the last portions of our country remaining to be thoroughly explored and settled. It has been practically inaccessible heretofore, for several obvious reasons, and was regarded of so little value that prospectors have left it severely alone. With the recent discovery of high-grade oil, conditions have changed. The district lies to the east of the Colorado river, where it cuts across the State, and along the course of the San Juan, before the deeper portions of the cañon have been reached. That is to say, between the settlements of Bluff City on the east and Oljato, or Moonlight, on the west, and south of the Blue and Henry mountains. The oilfields proper are about 65 miles across from east to west, and perhaps 75 miles north and south. The existence of oil has been known to the few Mormon settlers for many years, but it remained for a man from the Texas fields to make the first important discovery and set up a driller. That was five years ago; but not until last spring did the public take much interest, and only recently have other rigs been taken in to push the work. Now there are six or eight drilling outfits on the ground, with others on the way.

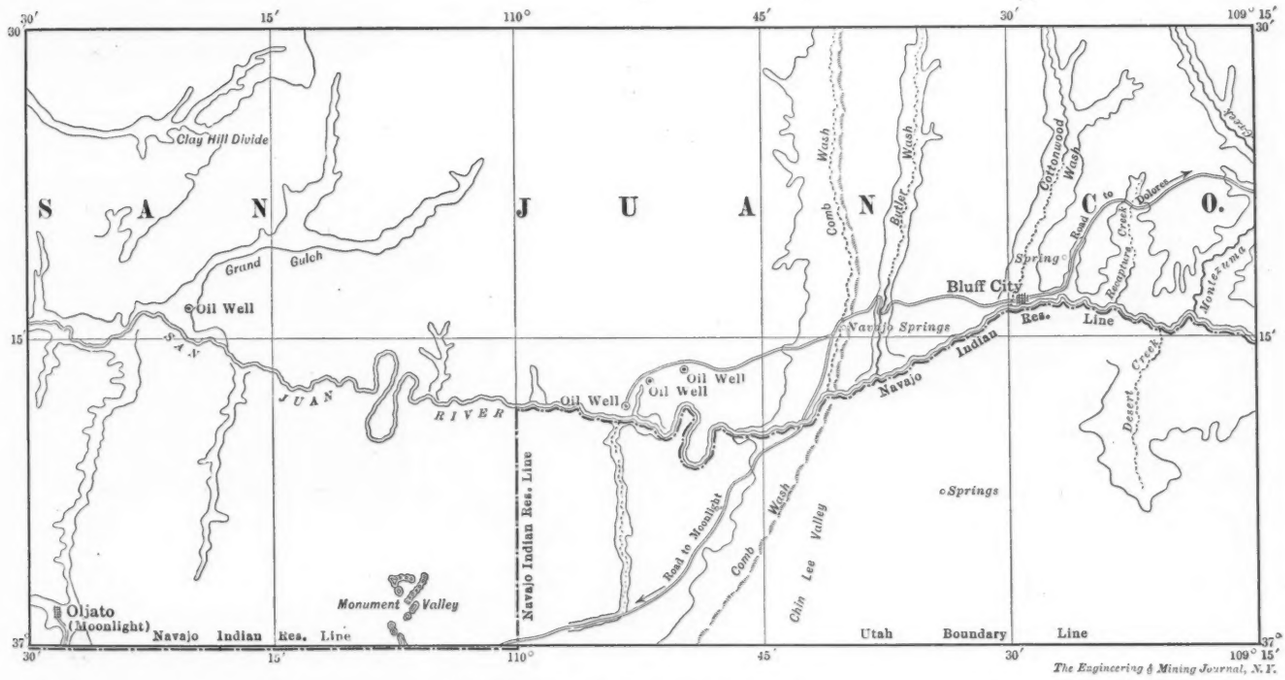
The country is sandstone, of the Jura-Triassic and Cretaceous ages, with occasional igneous ranges breaking through it, north or south of the known oilfield. A series of anticlines and synclines, formed by the folding of the earth's crust, have produced ideal conditions for oil deposits, and it is here all present prospecting is taking place. Bluff City is the nearest town, and there is only one railroad station anywhere near it—that at Dolores, Colo., on the Denver & Rio Grande Railroad, 80 miles away. Ten miles west of Bluff City lies the great Comb Wash, extending both north and south of the San Juan river for many miles, and from its western side an anticlinal fold rises over 1000 ft. above the river at its highest point. This is the eastern boundary of the field today. It can be followed west from this point more than 60 miles across two synclines and succeeding anticlines until the formation finally disappears below the surface near the Colorado river. Through these anticlines the San Juan river has cut deep cañons, and at various places oil seepages occur, especially from the lower sands close to the water. These cañons have exposed seven different oil-bearing sands in a depth of 1200 ft., varying in thickness from 3 to 60 ft., each one of which is sealed from the other by a strata of hard blue limestone.

In all, four wells were sunk up to December, 1908, the deepest of which is 320 ft., and the shallowest only 120 ft. Two of these struck oil and were gushers for a short time. The other two struck water in the upper sands, but as these were primarily sunk for assessment work, they are not classed as completed wells. The first and deepest well was sunk at the mouth of Grand gulch, encountering a fine grade of oil upon penetrating the fifth sand; this oil carries a higher percentage of volatile matter than any so far found in the West, and if it is obtained in quantity in other wells it will prove most valuable. No continued pumping has been attempted up to date, however.

As a result of these discoveries the surrounding country has been located for miles around, and large drilling machines, some with a capacity of 3000 ft., are being taken in to prospect the field in a systematic manner.

Anyone going into the district must make thorough preparations before starting; the summer weather is very warm and good water is scarce away from the muddy river. Supplies and equipment must be taken in, as practically nothing can be bought on the ground.

*Mining engineer, 52 Broadway, New York.



The Engineering & Mining Journal, N. Y.

NEW OILFIELD IN SOUTHEASTERN UTAH

According to *Engineering*, April 2, 1909, a bill was recently introduced in the French Chamber of Deputies proposing modifications in the present French patent laws. One modification provides for the loss of patent rights if the inventor has not worked the patent in France or her colonies within three years of the deposit of his demand, or shall have ceased to work it for three consecutive years, except for valid reasons. Working a patent almost exclusively or principally outside French territory, after a time fixed by the courts, will also be ground for revocation.

According to statistics collected for The Mineral Industry, the production of mineral wool in the United States in 1908 was 9197 short tons, valued at $77,228, as against 9008 short tons, valued at $81,769, in 1907.

The Distribution of Transvaal Gold

SPECIAL CORRESPONDENCE

In the February *Journal* of the Chemical, Metallurgical and Mining Society of South Africa there is an interesting paper on the above subject by T. Kirke Rose, of the Royal Mint, London. The years selected for analysis are 1905 to 1907, during which years South African gold amounted to 72, 71 and 75 per cent., respectively, of the total weight of gold imported into the United Kingdom.

For 1907 the figures were for gold imported into the United Kingdom:

	Oz. troy, gross.
British South Africa	8,012,437
British India	547,452
Australasia	803,961
Rest of the world	1,334,608
Total quantities	10,698,458
Total value	£39,956.304
Fineness of bullion, average,	879.2

The bullion on arrival in London is in part refined there, and in part reëxported in an unrefined state. In the period 1903-7 Doctor Rose estimates the amount of imported bullion that was reëxported without being refined at 15 per cent. of the total. Of the bullion imported into the United Kingdom a portion is retained in the country and a portion reëxported without delay.

The imports and exports for 1907 and for four years were:

	1903-07.	1907.
Imports	£151,973,235	£39,956,304
Exports	98.059,568	26,589,442
Excess imports	£53,913,667	£13,366,862

The greater portion of the gold retained in the United Kingdom is coined at the Royal Mint, the balance, which for the period 1903-7 is estimated at £6,361,300, being used in the arts, for the manufacture of jewelry, for gold plating, for the manufacture of gold leaf, in dentistry, photography, etc. The stock of bullion in the United Kingdom apart from the floating stocks held by refiners and bullion dealers, is in the vaults of the Bank of England. The Bank does not publish separate figures of the bullion and coin, but the two classes together amounted on Jan. 1., 1908, to £31,602,515. The bullion exported from the United Kingdom goes to the countries named in the following table:

Countries.	1903-07. oz. troy (gross)	1907. oz. troy (gross)
Continent of Europe.. (Chiefly France and Germany)	13,005,963	2,021,561
United States	6,063,671	3,143,700
British India	4,630,381	1,374,879
Rest of world	227,822	1,272
Total quantities	23,927.837	6,541,402
Value	£98,059,568	£26,589,442
Average fineness of bullion	964.8	956.9

The gold ingots sent to America have varied in amount more than those exported elsewhere. From 1903-7 (the year of the panic) they increased steadily from 158,945 oz. to 3,143,700 oz. The mean for the five years 1903-7 amounted to over 10 per cent. of the gold deposited at the United States mints. Of this total quantity in the years 1903-6, about 55 per cent. was coined, about one-seventh was used in the industrial arts, and the remainder was added to stock or exported. According to the United States Mint reports, however, the ingots exported are almost invariably United States fine bars, practically never foreign ingots. Also rather more than 40 per cent. of the imported gold bars were issued for use in the industrial arts in the years 1903-5. This would leave nearly 60 per cent. of the imported bars to be divided between coinage and additions to stock of bullion in the United States mints and assay offices. This stock is subject to great fluctuations; it was $124,083,823 on June 30, 1902, $51,-910,029 on June 30, 1905, and $104,383,158 on June 30, 1906.

The paper concludes with a chart showing the disposal of the Transvaal gold in the period 1903-7: Used in coinage, 58.6 per cent.; used in industrial arts, 30.5; deposited as ingots in the Bank of France, 3.5; total, 92.6 per cent.; leaving 7.4 per cent. undetermined.

A Crude but Efficient Sample Grinder

BY A. LIVINGSTONE OKE*

Junk heaps often contain much material that is useful, especially in remote mining camps, where supplies are not readily available. Some months ago, in view of the large amount of mine sampling and assaying to be done at La Gloria mine, Batopilas, Mex., it occurred to me to rig up a crushing roll and fine grinder to assist in the work. Fig. 1 shows the rolls which were made from two old vanner flywheels, and the bearings and adjustments from the side rods and brasses. The framing is of wood, as is also the hopper. The two driving pulleys are from disused vanners. This machine has put through over 2000 samples and is as good as ever. It cost 12 pesos to build. It is driven by two 3-in. belts at about 200 r.p.m. and is very powerful. Figs. 2 and 3 show the fine grinder with its pulp box attached and also removed for taking out the crushed sample. This consists of a heavy 3-in. shaft placed on end, with a flange above rotating at high speed below the upper swinging, but non-rotating, flange.

The sample is poured into the center opening of the upper flange and is discharged around the edges as in other disk machines. The upper flange is sufficiently heavy to prevent the pulp getting away until it is ground sufficiently fine. The pulp is received into a tin box, made in halves, hinged together, and entirely inclosing the two flanges. The upper flange is prevented from rotating by means of the wrought-iron yoke, fixed to the main upright at the back by a bolt passed through to form the fulcrum.

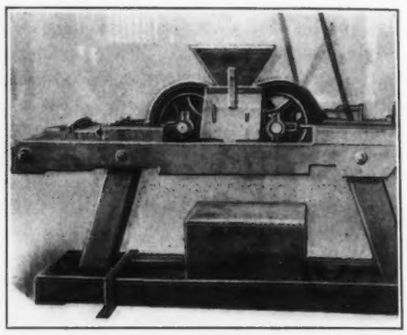


FIG. 1. IMPROVISED CRUSHING ROLLS

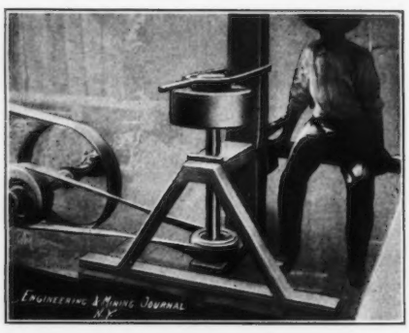


FIG. 2. FINE GRINDER WITH PULP BOX IN PLACE

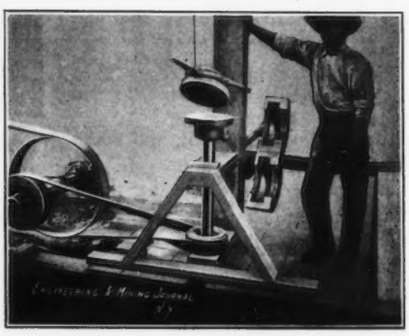


FIG. 3. FINE GRINDER WITH PULP BOX REMOVED

This yoke is also for lifting off the upper flange for cleaning between samples, and is also of use for putting extra pressure on the plates when necessary. The bottom foot-step bearing and also the upper one, were babbitted in the wood and have given no trouble. This machine puts through about 50 samples a day, with a Mexican boy working it.

*Clarke's Alameda hotel, Mexico, D. F.

Dredging at Butte

By A. Floyd Bushnell*

An interesting operation, the results of which will be watched with interest, is now in progress in the Butte district. It is the operation of the British Butte Mining Company's dredge which was built for the purpose of recovering gold from ground adjacent to the town of Rocker, four miles southwest of Butte. The dredge shown in the accompanying illustration, was started during January of this year, but the commercial results of the operations have not yet been announced.

The dredge was built by the Risdon Iron Works, of San Francisco, at a cost of about $80,000, after the plans of Col. M. H. de Hora, president and manager of the company. The hull of the dredge is 110 ft. long by 50 ft. wide, and 7 ft. 6 in. deep, with rounded bows. The lumber used in the construction of the hull and dredge was Oregon fir and the sizes of the principal timbers are as follows: keelsons, 12 x 12 in.; side stringers, 4 x 16 in.; center stringers, 4 x 12 in.; center uprights, 6 x 6 in.; frames, 6 x 8 in.; diagonal bearing, 6 x 8 in.; bottom and side planking, 4 x 10 in.; deck planking, 4 x 10 in. The hull is caulked and tarred below the water line, and thoroughly water-tight.

The gantries are built of timber uprights 14x14 in. x 40 ft. long, capped by steel box girders made of channels and plates, the tumbler gantry being further supported by two 12x16 in. diagonal braces and four 12x20-in. posts; all the posts and braces extend to the foundation timbers on the bottom of the hull and are fastened to the same with steel plates and angles.

The main ladder which supports the digging buckets is a steel girder 68 ft. long between centers, 74 ft. overall, 3 ft. 8 in. wide, 54 in. deep in the center and tapering to 30 in. at the ends. The ladder is hung at the top to the main gantry by means of a 10-in shaft, of 0.35 carbon steel and at the lower end is supported by rope blocks fitted with 36-in. cast steel sheaves with bronze bushings. The ladder rollers on which the bucket chain revolves are of manganese steel, 12 in. in diameter.

The upper tumbler which drives the buckets is a square of manganese steel with a shaft 11 in. in diameter running through it and fitted with renewable manganese-steel wearing plates. The lower tumbler has a 10-in. shaft. The buckets are of 6-cu. ft. capacity, built of heavy steel with manganese lips. Every alternating bucket is fitted with four manganese steel teeth. The buckets weigh 1,500 lb. each, and the connecting links 500 lb. There are 37 links in the complete chain and the pins connecting the buckets and the links are of forged manganese steel 2¾-in. in diameter.

The stacker at the stern of the boat is made of 15-in. steel beams, and is capable of stacking the tailings to a hight of 30 ft. above water at an angle of 30 degrees. It carries a string of close-connected steel buckets having steel links, bushed at both ends with manganese steel. The bucket belt is carried on cast-steel rollers, running in inclosed cast-iron bushings.

The main power winch comprises six drums, the head line drum being of double width, running on a 7-in. shaft; the four side line drums run on 5¼-in. shafts; the other drum is for spare line. The ladder winch, which is used for hoisting and lowering the buckets, is separate and is direct connected with a variable speed induction motor, both being mounted on the same bed plate.

The revolving screen or trommel is 32 ft. long over all and is 78 in. in diameter at the upper end, tapering to 54 in. at the lower end. All the perforated plates are ⅝ in. thick and perforated with ⅜-in. tapered holes, 1¼-in. pitch. Both the screen and the gold-saving tables are Col. de Hora's design. There are 20 tables, 10 on each side of the revolving screen; each is 2 ft. 6 in. wide and the shortest 8 ft. 6 in. long. They are divided in the middle by a cast-iron mercury trough.

BRITISH-BUTTE MINING COMPANY'S DREDGE NEAR ROCKER, MONT.

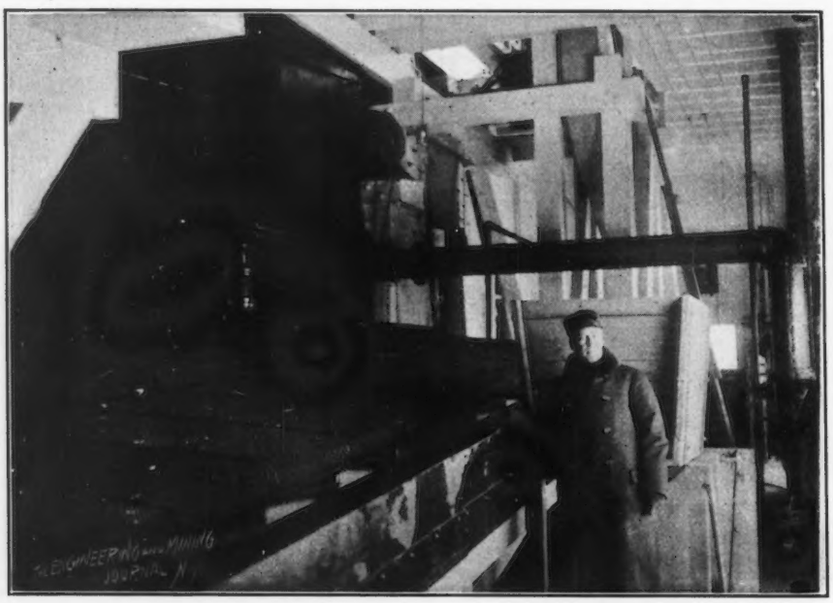
The tables are covered with cocoa mats and expanded metal, the ends of the matting being bound with brass cleats. All the fine material discharged from the screen is delivered on the tables by means of an inclined plate, fitted with an adjustable 18-in. feed roller having a length equal to the full width of the plate. The roller is driven in an opposite direction to the flow of the water at about one-half its velocity. Each table has an adjustable feed gate, and is also provided with a 1½-in. low-pressure water pipe. The tables are covered with heavy screen guards secured by Yale padlocks. The gravel from the tables discharges into side flumes, 2 ft. 6 in. wide, lined with angle iron riffles and fitted with a mercury trap at the lower end. The side flumes are so constructed that the fines can be discharged by means

*Butte, Mont.

of a centrifugal sand pump to the top of the tailings pile.

The water used on the dredge is obtained from the shaft on the property and is supplied by centrifugal pumps. An 8-in. pump driven by a separate motor discharges its water at a head of 50 ft. into the revolving screen; a 12-in. motor-driven pump supplies water at a head of 12 ft. to the feed rollers and gold saving tables.

The electric motors, of which there are nine on the dredge, are all of the induction type, 3-phase, 7200 alternations per minute, 60 cycles, 440 volts, and aggregate 300 horsepower. The dredge is electrically lighted and in cold weather is warmed throughout by radiators, the steam for which is supplied by a 40-h.p. Economic boiler. The wire ropes used are all flat-stranded crucible cast steel.



GOLD-SAVING TABLES ON THE BRITISH-BUTTE DREDGE

Instituto Mexicano de Minas y Metalurgia

This recently organized institution starts out with the prospect of a large membership, not only in Mexico, but also in the United States and Europe. Upward of 100 applications have already been received. The first meeting will be held probably in July of this year. The organization committee was composed of the following engineers:

MacDonald, Bernard	Grothe, A.
DuBois, E.	Blackburn, W. D.
Merrill, E. P.	Garrey, G. H.
Reynoso, J. J.	Farish, Geo. E.
Denny, H. S.	Denny, G. A.
Helm, J. D.	Thomas, Kirby
Mennell, J. L.	Bellwald, J. N.
Doveton, G. D.	Ordoñez, E.
Anderson, R. H.	Newcomb, C. S.
McNeely, W. M.	Brennon, J. H.
Braschi, V. M.	Simpson, H. H.
Babb, P. A.	Saunders, McConnell
Barker, H. A.	Narvàez, F.
Girault, E.	Empson, J. B.
Enos, H. C.	Johnson, J. M.
Read, H. L.	Chism, R. M.

The constitution was framed by drafting what was deemed best from those of the technical societies in the United States, England and South Africa. There are to be three classes of members, namely, members, associates and honorary members. In order to be eligible for full membership, a candidate must be at least 25 years old, and must produce evidence of a good general and scientific education, regular training as a mining engineer or metallurgist, and engagement for a sufficient period in an important position of responsiblity; or he must have had at least five years of practical mining and metallurgical experience. The annual dues are to be 20 pesos for members and 12 pesos for associates, besides which there is an initiation fee of 20 pesos for both members and associates. Meetings will be held monthly in the City of Mexico, besides which there will be district meetings in various parts of the Republic whenever there is a sufficient membership in the district to insure a successful meeting. The proceedings of the meetings are to be recorded in Spanish, but any member may make a motion or enter into discussion, or submit a paper either in Spanish or English, such motion or discussion or paper to be published in the proceedings in the language in which submitted, with an accompanying record or synopsis of the same in the other language.

The Organization Committee elected under date of April 13 a provisional council, composed of the following:

Thomas, Kirby	Reynoso, J. J.
Babb, P. A.	Denny, H. S.
Braschi, V. M.	Anderson, R. H.
Grothe, A.	Girault. E.
Ordoñez, E.	

Much good will toward the new organization has been expressed by the officials of the Government who are thrown into relations with the mining activities of the Republic, and also by such institutions as the Mexican Chamber of Mines.

Screening at the Utah Copper Mill

By H. B. Lowden*

As originally designed and equipped the mill of the Utah Copper Company at Garfield, Utah, contained trommels as the main screening equipment in the roll crushing department, the undersize passing over stationary inclined screens. Each of the twelve units comprised four trommels, 48x144 in., and two of the inclined flat screens, the trommels being clothed with rolled-slot wire cloth equivalent to about 6 mesh and the stationary screens with similar material passing a product equal to about 20 mesh.

Shortly after the first units were placed in commission, difficulties in the operation of trommels made themselves felt and more efficient and economical screening equipment was sought, to which end a number of devices were systematically tried on a large working scale. The results of these tests were so conclusively favorable to the impact screen that it was determined to equip the twelfth unit, at that time nearing completion, with these screens and to demonstrate conclusively the adaptability of the machine for the work. The twelfth unit was operated with decidedly improved results and with a capacity of 600 tons as against the 500-ton capacity of the other units, owing to the tables being able to handle a greater tonnage of the more closely sized feed. The screens in this unit were running wet.

The work of replacing all the screens throughout the other units of the mill was then determined on, and has proceeded as rapidly as possible without undue interference with operations. Sufficient time having now elapsed to permit of comparison between the two, the net result of the change can be summarized as follows: The capacity of each unit has been increased from 500 tons to 600 tons per day, the tables handling the increased feed by reason of its closer sizing; the saving of about one-fourth of the water used by the trommels is effected by running the four coarse impact screens, the crushing rolls and the elevator dry, this also increasing the life of the elevator by several months; the expense for screen cloth is also reduced, the cost of renewals being in the ratio of $128 for the trommels to $14 for the impact screens.

*Denver, Colo.

A New Coal Washery in Michigan

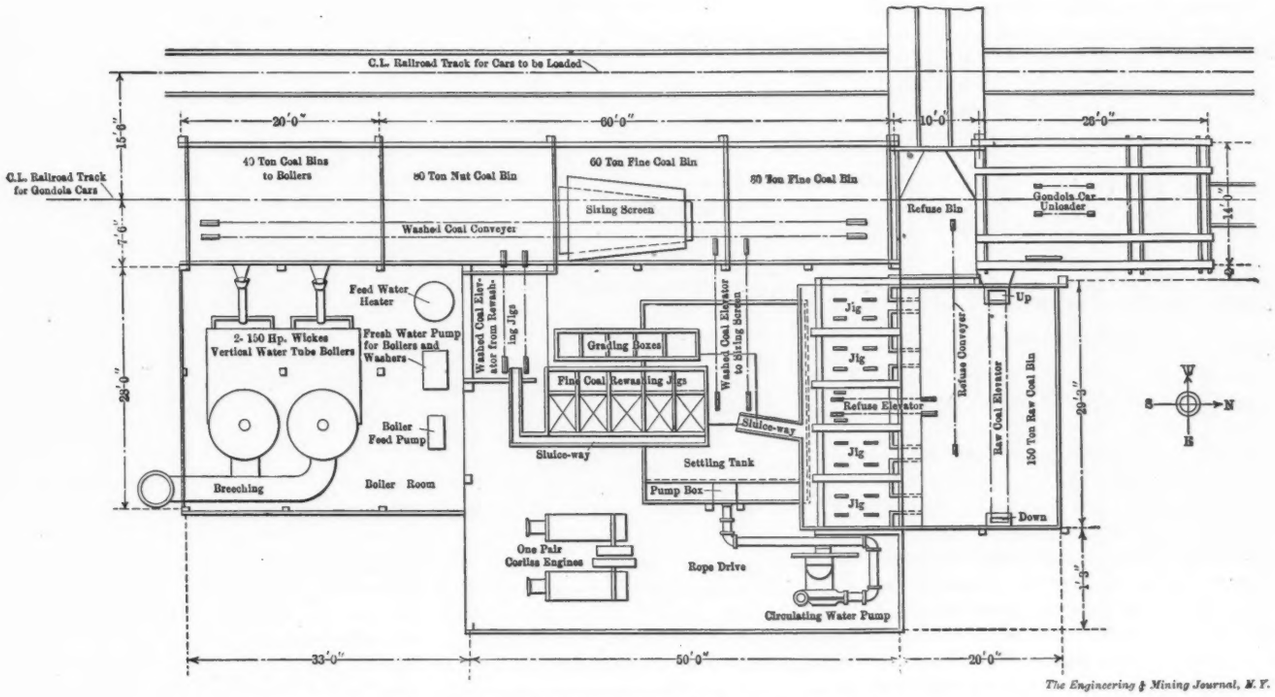
The Coal Averages about 15 Per Cent. in Ash, and Contains a Quantity of Crystallized Pyrites, so that Specially Designed Methods Are Used

BY LEE FRASER*

The Link-Belt Company, of Chicago, has recently completed a bituminous-coal washer, with a capacity of 100 tons per hour, for the Consolidated Coal Company, at Saginaw, Michigan.

The Consolidated Coal Company operates 9 mines, situated in both Saginaw and Bay counties. and produces 900,000 tons of coal per annum, 275,000 of which is slack coal. Conditions prevailing at the mines of the company make it impossible to deliver a uniform grade of slack coal, the ash percentage fluctuating between 3 and 40 per cent., and averaging about 15 per cent. But under the present operating conditions, 18 per cent. by weight of the raw coal is removed in washing, and the coal is separated into a nut size, passing over a 1-in. perforation, and a fine coal, both passing over and through a ¼-in. perforation. The undersize from the ¼-in. perforation is not blended directly with the oversize, but rewashed in Luhrig jigs, and then mixed with the oversize from the ¼-in. screen. The resulting fine coal contains 5 per cent. ash, while the nut coal contains 2 per cent. ash.

Considerable difficulty, however, was first experienced in adjusting the Stewart jigs to make the best possible primary separation. There is a great difference in the character of the various coals to be washed, the coal not coming from one mine, but from nine. Coal from Saginaw county is uniformly heavier and more free of ash, while coal from Bay county is lighter and much heavier in ash, and contains, as a usual thing, a quantity of pyrites, which has often been found to have crystallized out into pieces as large as an egg. The adjustments, however, have been perfected to an extent where the loss of coal in the refuse is a minimum, the principal loss of coal being in pieces which have a specific gravity greater than 1.35 due to some attached slate or pyrites.



The Engineering & Mining Journal, N. Y.

GENERAL PLAN OF NEW COAL WASHER IN MICHIGAN

Method of Treatment

The raw coal is unloaded with a gondola-car unloader, having a maximum capacity of 100 tons per hour, and is discharged into the raw-coal elevator conveyer, having a capacity of 240 tons per hour at a speed of 100 ft. per min., by which it is carried to the raw-coal bins, which are built to accommodate 150 tons of raw coal. The bins are provided with the Link-Belt "Spellman" bin gates and tank, into which it is discharged by the primary jigs, by an elevator with a maximum capacity of 100 tons per hour at a speed of 33 buckets per min., and is then discharged into a double trommel for sizing. The inner shell of the trommel is of 5/16-in. steel plate, with 1-in. round perforations, 5 ft. at the small end and 7 ft. at the large end, and 14 ft. in length. The outer shell is of 3/16-in. steel plate, ¼-in. round perforations, 7 ft. at the small end, 9 ft. at the large end and 13 ft. long. Here the coal is rinsed and sized.

The oversize from the inner shell is conducted directly to the washed nut bin. The oversize from the outer shell is taken

*Mining engineer, Saginaw, Michigan.

directly by the distributing conveyer to the fine-coal bins, while the undersize runs directly to the grading boxes for the Luhrig jigs, and then to a battery of 5 Luhrig fine-coal jigs. The refuse from the Luhrig jigs runs into the refuse tank for the primary jigs and is elevated with the other refuse and conveyed to the dump. The fine coal recovered by the Luhrigs is elevated from the secondary settling tank to the distributing conveyer, which has a maximum capacity of 90 tons per hour at a speed of 85 ft. per min. This conveyer handling both the oversize from the outer shell of the trommel and the fine coal recovered by the Luhrig jigs insures a uniformly mixed fine coal in the bins.

The plant is also arranged so that the distributing conveyer for the washed coal will deliver to bins in front of the boiler. And further, raw coal may be received from the raw-coal elevator conveyer by the washed-coal distributing conveyer and delivered to the bins in front of the boilers.

The overflow from the main settling tank is kept circulating through the jigs and sluices by a 12-in. L. H. Morris double-suction centrifugal pump with a lift of 27 ft. at 320 r.p.m. Power is supplied by a pair of Corliss engines and all drives are of manila rope. Steam is generated in two 150-h.p. Wickes vertical steam boilers.

Notes on the Norton Hill Colliery Explosion

By H. M. Morgans*

A recent report of Joseph Martin, inspector of mines for the southern district of Great Britain, deals with an explosion that took place at the Norton Hill colliery, Radstock, Somerset, England, in April, 1908. A perusal of the report shows that the inspector was from the outset inclined to exclude firedamp from having played a part in the explosion.

As the action of firedamp and coal dust in explosions is of such universal interest and importance, the evidence supporting the possibility of firedamp having been present may usefully be set out more fully than is done in the report.

The explosion was undoubtedly initiated by the firing of a shot part ways up an incline driven in a coal seam. The return air traveled down this incline. That the explosion did not start at the shot but at the bottom of the incline, where a boy with a naked light stood, is supported by the two following circumstances:

1. The explosion progressed in all directions from the boy as center.

2. The coal dust on the down side of the timbers (and not on the up side) in the incline was charred and small stones had been shot up the incline and were to be found embedded in the timbers as if projected uphill and against the air current. Obviously the explosion traveled up this incline toward the spot where the shot had been fired. The inspector does not express an opinion on this point.

Both near the shot and near the boy, old roads, stowed with rubbish, communicated with old workings in the seam, recently full of water but unintentionally drained. Undoubtedly firedamp had accumulated in these old workings possibly generated through decomposition of timber, etc., and had been noticed.

The formation of firedamp in this way is well known, and two other similar cases have come to my knowledge. One was in a Somersetshire colliery where gas was fired near old workings without serious results—these workings having been drained only a short time previous, after having been filled with water for more than 80 years. The other was in a gold mine in India, where old workings which had long been filled with water were struck and gas was fired. Of course, it is well known that firedamp is often generated at the bottom of ponds.

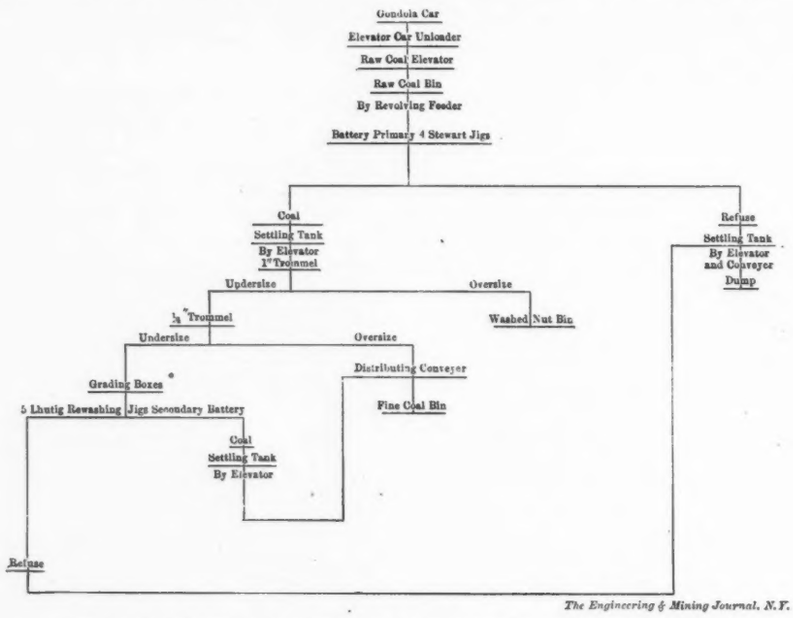
The inspector reports that explosions could easily be obtained with the dust found in various places in the track of the explosion, but does not say if such explosions could be set up by a naked light, which was evidently what initiated the Norton Hill explosion.

The incandescent explosion gases rushing from the incline bottom to the downcast shaft (up which they found vent after shattering the separation doors) passed the entrances of two roads—one on either side and nearly opposite each other. In one of these, in which the horses were stabled nearby, an explosion occurred (fatal to all the horses) though it was virtually free from coal dust. In the other road which had an abundance of coal dust on floor, sides and roof, no inflammation occurred, but the force of the explosion was felt by men working in this road at a place a long distance inbye.

Some of the roads along which the explosion did progress were not dry and dusty. On the contrary, they were distinctly wet.

That coal dust plays a most important part in explosions is now universally recognized, but in view of the facts set out above it cannot be said to have been proved that the Norton Hill explosion was a dust—and nothing but a dust—explosion.

[In connection with the foregoing notes, the following abstract of the official report on the Norton Hill explosion will be of interest: The accident occurred about 9:45 p.m., on Thursday, April 9, and caused the death of 10 persons who at that time were employed underground in the affected district. Some of the bodies showed the effect of severe burning, others of having been badly bruised by a considerable force, and others as if death was due simply to poisoning by carbon monoxide contained in the afterdamp or fumes. There were also five horses killed in this explosion. The report states that the inquiry was a protracted one because the explosion had been attributed to gas instead of dust. The jury, however, did not accept this explanation of the owners, and in their verdict, stated that the explosion was due to the ignition of coal dust, caused by a shot fired by one of the miners. About 380 men and boys were employed at the colliery, but at the time of the explosion 30



FLOW SHEET SHOWING GENERAL ARRANGEMENT OF THE COAL WASHERY

*Engineer, Broad Street House, London, England.

only were underground working on the night shift. The inspector states in his report that the roadways were dry and dusty. It is also mentioned that a number of the managers of the Somersetshire collieries have considered the dust of these mines inexplosive, basing their belief on the report of the Royal Commission, which states that no explosion resulted from tests made on samples of dust received from the Somerset collieries. These collieries considered the necessity for watering, outside the considerations of practical mining in the Somersetshire coalfield. At the inquest an eminent analytical chemist was called in to prove whether the dust could be exploded. In the evidence submitted by this expert, he says that he tried to explode the dust by means of a naked light, a detonation, and firing a small cannon into it under varying conditions, and that although he obtained an ignition, he did not succeed in getting an explosion, so that he considered the dust nonexplosive. This same authority stated that he had several samples of air and a sample of water submitted to him for analysis, and that he found no trace of firedamp (CH_4) in any of the former, but that the latter—water which was given off from old workings—contained in solution 4.23 per cent. of gas by volume. The presence of this firedamp in the water indicated, as he explained, that changes and decomposition of organic matter were going on in this old goaf.

Disturbance of this so-charged water, he stated, might result in some of the gas being evolved. Referring to this evidence, the inspector states: "It appears to me, as it also did to most others versed in mining, who attended the inquest and followed the case, that since no trace of firedamp was found, or even thought at any time to have existed, during the present or former working of the mine, it is idle to suggest that firedamp could possibly have had any connection with the explosion."

Evidence of Experts

The inspector also referred to the evidence of Thomas Morgans and George Batey, both experts, who voiced the opinion that the explosion was due to an accumulation of gas. Mr. Morgans attributed the explosion to an ignition of firedamp at the bottom of the Slyving Vein incline, and accounted for the presence of the gas in the mine by its having been given off from the water (from 8000 cu.yd. which had been contained in the 20-acre part of the old workings, and which had been unintentionally and unwittingly drained, between Feb. 6 and March 8, through the leader of a fault which was recently cut. Mr. Batey gave it as his opinion that the explosion was due to gas accumulated in a cavity in the roof of the incline on the higher side of the fault, being expelled by the concussion resulting from the shot, and that it was ignited by a boy with a candle at the bottom of the incline. The inspector states that he does not consider either Mr. Morgans' or Mr. Batey's theory a true and practical explanation of the causes which brought about the accident, and further states that dust and not firedamp was the explosive agent operated upon by a shot which was fired about 40 yd. from the bottom of the Slyving Vein incline. Mr. Martin, the inspector, tells of his investigation as to the explosibility of the dust at the Norton Hill mine and gives his results as follows:

"1. The dust from the Slyving Vein's clean coal exploded violently. 2. The dust from the vicinity of the shot in the Slyving Vein incline exploded with violence, although not as violently as the clean coal. 3. Those samples taken from the upper part of the same incline and the intake road in the Middle vein exploded, respectively, with lower degrees of force,"

Mr. Martin continues. "In making these tests or experiments, the point which struck me particularly was the small quantity of dust which was necessary, and indeed most effective in obtaining explosions. When a considerable quantity was present, it seemed as if it choked itself through want of oxygen, and that, although we obtained combustion in the tubes, it failed to explode. The results fully confirm the opinion I had formed, and having shown that at the point where the shot was fired, flame and dust were accounted for in a manner which can result in an explosion, it appears to me quite unnecessary to enter upon improbable theories to account for this explosion and its resultant effects. The shot, at the point indicated, was unanimously accepted as the starting pont, whether, as suggested by Mr. Morgans, by creating a partial vacuum and sucking gas from the goaf, or by shaking the roof so as to cause it to sink or come down a small amount, or both, and thus expel gas, or by dislodging gas from the cavity in the roof of the incline, as suggested by Mr. Batey. The indications of the direction of force are also unanimously accepted, except in the length between the shot and the bottom of the incline."

Action of the Suspected Shot

In explaining the action of the suspected shot, Mr. Martin states further: "This shot hole, if the evidence is to be relied on, was only about 13 in. deep, but was in hard ground, and would consequently have had a fairly heavy charge apportioned to it in proportion to its depth, with a view of ripping the roof over as large an area of the road as possible. Owing, however, to a joint or slide at the right-hand side, which was, no doubt, previously unseen, the resistance was largely reduced, with the result that the hole was overcharged, the ground simply smashed down from a limited area, and a considerable amount of flame at a high temperature was evolved, which ignited fine dust, lodged on the side and floor. This, when once started, would raise sufficient dust in the air from the floor, roof and sides to feed itself and carry the explosion forward as in other cases."

In closing his report, Mr. Martin states, "The effect of this experience will, I believe, be, not only to satisfy managers and others connected with Somersetshire collieries that they are not immune from the dangers of coal dust, but also still farther to impress the necessity of watering upon those who, having previously realized the danger, have shirked the trouble and expense of carrying it out. I have no doubt that, had there been even a small percentage of gas in the air, the damage and force of the explosion would have been greater and probably extended farther into the new vein."

It is evident from the foregoing notes, that English engineers differ as widely in their conclusions as to the initial cause and active agents in some of their explosions, as we in America. It is so probable that both dust and gas are active in all coal-mine explosions that it is often difficult to say definitely which agent is most to blame.—Editor.]

The Oxidation of Coal*

By O. Boudouard

The study of the atmospheric alteration of coal has an important practical bearing in at least two directions. The spontaneous ignition of coal, with its occasional disastrous consequences, and the coking qualities of a coal. The work of Fayol and Mahler has shown that spontaneous combustion of coal is a direct result of oxidation of carbonic matter, while it is a matter of common knowledge that the percentage of volatile matter in a coal is not the only factor governing its coking qualities, and that of two samples of the same coal, the one that has been longer exposed to the atmosphere yields the poorer coke. Mahler thinks that a careful study of the behavior of coal when subjected to oxidation might shed light on the disputed question as to the relation between coal composition and coking qualities, and believes that the fundamental requirement of a good coking coal is that it shall contain certain carbohydrates, such as will be transformed into humic acids upon contact with air. Dennstedt and Bünz think that humic acids are the ultimate products of the decomposition of coal, and that those coals that yield the larger proportion of humic acids are the more susceptible to spontaneous ignition.

*Abstract of a paper presented to the Académie des Sciences.

As a contribution to our knowledge of this subject, I have made a series of comparative experiments on the following coals: I, English anthracite; II, one-fourth *gras* from Courrières; III, Belgian forge coal; IV, forge coal of unknown origin; V, three-fourths *gras* from Bruay; VI, coal of unknown origin; VII, lignite. The coals were analyzed by ordinary methods for fixed and volatile carbon and ash and the amount and quality of the coke yielded by heating in a closed crucible were noted. One set of samples was exposed to the air at ordinary temperature, and another at 100 deg. C. At ordinary temperatures the variations of weight, due to oxidation, were very slight, and might have been caused by changes in the hygroscopic state. At a temperature of 100 deg., on the contrary, after a diminution in weight due to loss of moisture, a distinct increase in weight took place, amounting in some cases to 10 per cent. Other tests at the same temperature on larger quantities of coal gave similar results.

SEVERAL ANALYSES OF COAL, BOTH NATURAL AND OXIDIZED.

Sample No.	I	II	III	IV	V	VI	VII
Original Coals.							
Volatile matter	8.80	8.80	24.85	18.14	37.57	46.21	58.44
Fixed carbon	86.66	89.54	70.51	79.18	59.36	51.44	37.34
Ash	2.54	1.66	4.64	2.68	3.07	2.35	4.22
Coke was	loose	loose	porous	porous	porous	sl. por.	loose
Exposed to Air at 15 Deg. C.							
Volatile matter	7.60	10.07	23.60	18.50	35.31	46.31	57.77
Fixed carbon	90.10	87.86	71.67	75.59	62.04	51.74	35.50
Ash	2.30	2.07	4.87	5.91	2.65	2.95	6.73
Humic acid	none	none	none	none	none	trace	yes
Coke was	loose	loose	porous	porous	compact	loose	loose
Exposed to Air at 100 Deg. C.							
Volatile matter	9.83	12.51	23.83	20.85	32.92	47.25	66.55
Fixed carbon	87.84	85.32	71.98	72.83	64.69	43.75	25.60
Ash	2.33	2.17	4.19	6.32	2.39	9.00	7.85
Humic acid	none	none	trace	trace	yes	yes	yes
Coke was	loose	loose	loose	loose	loose	loose	loose
Treated with Nitric Acid.							
Volatile matter	30.10	44.81	41.95	42.27	48.76	56.04	59.91
Fixed carbon	68.10	54.78	56.50	51.59	49.64	43.24	39.48
Ash	1.80	0.41	1.55	6.14	1.60	0.72	0.61
Humic acid	none	none	yes	yes	yes	yes	yes
Coke was	loose	loose	loose	loose	sl. por.	sl. por.	loose
Change in weight, per cent	+15.6	+26.0	+6.4	+20.4	+17.2	−14.0	−36.8

Action of the Humic Acid

Humic acid, the presence of which was determined by leaching the coal with potash and precipitating with hydrochloric acid, was present in the original coal only in sample VI (less than 1 per cent.) and sample VII (5 per cent.); after exposure to the air at 100 deg., humic acid was distinctly present in samples III and IV (trace), V (5 per cent.), VI (14 per cent.) and VII (1 per cent.). At the same time, the coking qualities of samples III, IV and V, which in their natural state yielded a firm, compact coke, had entirely disappeared. It would seem, therefore, that there is some relation between the absence of humic acid and the coking qualities of a coal.

The increases of weight due to oxidation can be much more forcibly demonstrated by treating a coal with some energetic oxidizing agent, like nitric acid. As soon as nitric acid is put in contact with a coal, a liberation of nitrous fumes takes place, which are the more abundant as the coal is richer in volatile matters; the reaction generates heat also in proportion to the percentage of volatile matters. Oxalic acid can be distinguished as one of the the products of the reaction, and by leaching the oxidized coal with potash the presence of a relatively large percentage of humic acid can be demonstrated. After a treatment with nitric acid, samples III, IV and V had lost completely their ability to coke.

The treatment of coal by nitric acid must produce a number of unstable nitrous compounds, because the most careful heating, far below red heat, causes bubbling and a liberation of incombustible vapors. The variation in the weight of coals thus treated would indicate that the loss of volatile hydrocarbons is sometimes greater and sometimes less than the accompanying increase in weight due to the fixation of oxygen and the formation of humic acids. Samples VI and VII in particular, at the moment of reaction yielded an increase in temperature sufficient to liberate hydrocarbons and decompose the newly formed nitrous compounds, resulting in a loss of weight.

The total production of all kinds of cement in the United States during 1908, according to U. S. Geological Survey figures, was 52,775,925 bbl., valued at $44,376,656. This output was divided as follows: Portland cement, 51,002,612 bbl., $43,472,679; natural cement, 621,862 bbl., $808,509; slag cement, 151,451 bbl., $95,468. There was a heavy decrease of production in most of the Eastern and Southern States. The average price of the entire portland-cement output in 1908 was only 85c. per bbl., 36c. below the average price in 1907.

Round Mountain Mining Company

The annual meeting of stockholders was held at Goldfield, Nev., April 19, and the following directors were elected: L. D. Gordon, Thomas Keane, W. H. Bryant, James R. Davis, president and general manager, and J. P. Loftus, vice-president. W. E. Johnson was elected treasurer and H. G. Mayer, secretary and assistant treasurer.

The manager's report states that the development work done for the year ending March 31, 1909, was 6775 ft. The main incline shaft was sunk during the year a distance of 196 ft. making a total depth of 783 ft. and four new levels opened, the 500, 550, 600 and 700. These levels were driven a total distance of 281 ft., 567 ft., 497 ft. and 254 ft. respectively.

From the main shaft 29,582 tons of ore were extracted during the year and 31,962 tons blocked out ready for stoping.

During the year the company milled 29,582 tons of ore, producing a total of $349,505 and a net profit of $169,889. The cost per ton of ore mined and milled has been reduced from $7.06 to $6.07 per ton. The company has let contracts for additional mill machinery, air compressor, air-drill equipment, 50-h.p. hoist and motors, and has entered into contract with the Nevada-California Power Company by which the power costs will be reduced approximately 20 per cent., and by the use of the new equipment mining and milling costs should be reduced from 15 to 25 per cent. During the year the company paid $127,901 in dividends.

Vanadium in Peru

By S. Jochamowitz

Particular interest attaches to the rare minerals of Peru, of which vanadium is becoming of importance. This mineral was found in the vicinity of Sierra de Pasco by A. R. Patron, engineer of the Huaraucaca smelter. The mineral is a sulphide of vanadium, and was given the name patronite from its discoverer. It occurs in veins, some of which reached a width of 15 ft.; the outcrops have been traced for several hundred feet. Shortly after the discovery (November, 1905) a company was organized for the purpose of mining the deposits. Regular shipments are now being made to the United States. The quantity exported during 1908 was over 600,000 lb. The ore is handled mostly by the American Vanadium Company, by whom it is converted into ferro-vanadium at Pittsburg. The mineral is of a relatively low specific gravity and has a dark color and green streak. In addition to vanadium, the ore contains some molybdic oxide, silica, alumina, iron and sulphur, and is believed to be a mixture rather than a chemical combination.

*Mining engineer, New York.

Topographic Engineering

By W. D. Blackburn*

It is the purpose of this article to place before the readers of the Journal, with especial reference to engineers and those in charge of geologic and mining work, a few of the many facts in relation to the field of topographic engineering insofar as I am able.

Geologic

The mining geologist does not depend alone upon the underground work of a mining property; in fact, it forms a small part of the data from which he draws conclusions and makes recommendations. It is in connection with the geological features of the surface that the nicer questions of formation and mineral possibilities arise, and here it is that the topographic map is of such advantage and importance that it is an absolute necessity for any other than the most general and indefinite work.

With a topographic map in hand showing the relief of the country with accuracy, and points of especial geologic, topographic and cultural interest plotted upon it, the geologist is enabled to place upon the map with absolute correctness the boundaries of the different formations and other geologic features, so that he has before him a complete geologic picture of the country, together with the topography, the whole forming a graphic expression of information from which conclusions can be drawn easily, quickly and correctly. Not only does the map show the area in plan, but it has within it the information and data necessary to the construction of innumerable sections. Sections can be constructed at any point, or for any distance, and for this reason any part of the area can be shown with its reference to the surface profile. By combining a survey of the mine workings with the topo-geologic sheet it is possible to obtain more and clearer information concerning the relation of the workings and surface than can be secured and expressed by any other method of survey and mapping.

Mining

But it is not for the mining geologist alone that the topographic map has interest, or is of value. To the men engaged in mining and particularly in development work a map of this nature should prove of inestimable service. For the purpose of illustrating this, two cases will be discussed.

Case 1. A mine in process of development has a tunnel driven a certain distance, and it is desired to make a connection with the surface for the purpose of ventilation and to better facilitate the extraction of the ore, the work to be prosecuted simultaneously as a raise from the tunnel and as a shaft from the surface. The usual method would be to run: (*a*) A transit line from the point in the tunnel at which the connection is desired to the surface point immediately overlying; (*b*) a line of levels between the two points; and (*c*) to compute the lines thus run and, finally, to plot the results. The work may even then have only a negative value so far as the present demand is concerned, for the surface point may be, to say the least, disadvantageous as a location for shaft purposes. It is unnecessary to dwell upon the time, patience and labor required to obtain this information. Those who have had experience therein know the fact too well to require that special attention be called to it. Let us see if a topographic map combined with an underground survey would help in the solution of the problem. The map has definitely located surface points plotted upon it and also the underground workings drawn to the same scale. It is obvious that any point in the workings has its relative surface point in plain view upon the map. We may choose the most suitable point for the shaft at any time while development is in progress, and we already know, from the map, its approximate location. To determine its exact location we have recourse to the nearest or most accessible definite point, and by measurement therefrom and the determination of the course from the coordinates of the map we are able to go into the field and fix the point upon the ground with certainty. We can note from the contours the respective elevations of the tunnel mouth and the surface point just determined and, by subtraction, arrive at the depth of shaft required and make the necessary calculations as to time required for sinking and cost. By the expenditure of an hour's time we can construct a profile along the line of the tunnel and the overlying surface and we have all the information necessary to this particular connection. Further, we have all information necessary to any other connection which may be desired along this line within the limits of the topographic sheet.

Case 2. Development has been in progress at two different points within the boundaries of a group of claims. These points are widely separated both vertically and in plan. It is desired to make a connection between them by means of a third opening which will, at the same time, develop new ground. The surveys and maps necessary to the correct solution of this problem would entail a great deal of time and labor and still be subject to the same criticism as the work done in case 1; that is, it would be of negative value only. I do not wish to be understood by the use of the term "negative value" as meaning that whole work is useless. The point I desire to make is, that if the work determines that the place fixed by the survey is disadvantageous, another point will have to be determined before the work of making the connection can be begun. The chief objection to the usual method of obtaining the necessary data for connections of this sort is the time and labor it entails in the matter of field work, computation and mapping. It is not an unusual thing to make several surveys before the final result is that striven for.

With a topographic map of the same description as used in case 1 spread before us, we can see at a glance the relations of the workings between themselves and the surface overlying them as well as that adjoining; we can determine the best point for the location of the new working with the view of accomplishing the most in every possible way; and we can decide upon the future progress of the underground headings both as to distance and direction. This can all be done without an hour's field work with no reference to notes, and with absolute knowledge that the best method has been chosen from every possible one open. The projection of the workings first, with reference to points within themselves; second, in reference to each other; and finally, with reference to the surface, will place before us, in connection with the plan map, all the information necessary to a correct estimate of the time and cost of the connection, since from the two we obtain, not only distance and direction and relative elevations, but also information concerning the form of opening best suited to the work and the formation of the ground topographically and geographically.

Other Cases

These are only two of the many cases which are continually presenting themselves for adjustment to those who are engaged in mining, cases where it is difficult to determine the best method of procedure under all circumstances and where a map of the kind we are discussing would be invaluable in placing all the data in a clear and accurate form before the man who has to decide such questions. Among the many other examples which might be brought forward in this connection are those relating to railroad and tramway construction and the collection of data necessary to the computation of cut and fill, bridge and trestle work, location of towers, etc. Oftentimes it becomes necessary to know the topography of the country surrounding a mine in order to obtain data with reference to the construction of pipe lines, canals, or conduits. It is necessary to emphasize the value a good topographic map would have in the solution of problems of this class where the thing most desired is a means of arriving at a decision after all possibilities have been considered. There is nothing that will take the place of a graphic method of expressing information, and it is this that the topographic map possesses in the fullest sense and largest degree.

*Topographic engineer with Spurr & Cox, Inc., Apart. 2707, Mexico.

Surface Trials in Rand Stope Drill Competition

Twenty Machines in the Contest, Fourteen Qualifying for Preliminary Underground Test; Piston Drills Leading, Hammer Drills Close Second

BY EUSTACE M. WESTON

The stope-drill competition, held under the auspices of the Transvaal government and the Transvaal Chamber of Mines, has been completed as far as the elimination surface trials are concerned. Three-day underground trials are now being held and the machines which survive these will be given 300 shifts of continuous underground work, two machines of each class being kept at work. Generally speaking, the final award is to go to the machine that succeeds in drilling the greatest footage at the least cost for labor, repairs, motive power, supplies, etc. The first prize is $20,000 and the second, $5000. The air pressures supplied will vary from 60 to 80 lb. at the end of the pipe line.

The entries for this widely advertised contest numbered 20, including machines from the Transvaal, England, Germany and Scotland. From America only two entries were received, the Murphy and the Waugh. Neither the Ingersoll-Rand nor the Sullivan companies were represented. Locally-designed drills were much in evidence. In the results given, which are taken from the official reports, air consumption is calculated per linear foot drilled and in cubic inches per minute. The consumption per foot drilled cannot be taken as an accurate standard of comparison, as some machines, particularly the Anderson, used larger sized steel and bored a larger hole than others. The only regulation in this respect was that holes should be from 42 to 48 inches deep and to be of 15/16-in. diameter at the bottom. However, most of the drills used bits of, approximately, the same diameter, so the comparison is valuable, if not exact.

The Weight Limit

Perhaps the most important regulation in connection with the competition was that the drills should not weigh more than 100 pounds and should, if possible, weigh less. A modern American drill manufacturer or miner would at once conclude that hammer drills were the only drills which would have any chance in such a contest. I have, however, in a former article, pointed out that conditions in this field are very different from those in most American mining districts. Stopes are inclined about 30 deg. to the horizon on the average, and where small machines are used, are from 30 to 50 in. high. The ground is very hard in most cases. A bar and clamp must always be used and 95 per cent. of the holes are down holes drilled with water.

I, therefore, expressed the opinion that despite the theoretical advantages possessed by hammer drills, a suitably modified piston drill stood a good chance of holding its own for such work. Hammer drills had to work with hollow steel injecting air and water, or air or water alone into the hole. They had to be provided with some sort of cradle with automatic air or screw feed, and thus abandon much of their great advantage of portability, as when used for boring uppers with air feed alone. Similar conditions occur in the North Star mine, Grass Valley, Cal., and there the 2¼-in. piston drill thus far holds its own. The Gordon drill had shown that it was possible to make a very light hammer-drill machine giving a large output of boring power per unit of weight, but its failure under the rough working conditions of the Transvaal with its unskilled black laborer and much inferior white labor, showed that improvements were needed in both the design and the material used in the construction of such a type of machine.

Changes in Design of Piston Drills

Makers of piston drills on the other hand had to combine large output of power (in order to compete in boring speed with hammer drills) with the light weight required by the conditions of the trial. Obviously some features of the standard designs had to be sacrificed. Weight was generally economized by shortening the stroke, by shortening the piston and cylinder and by cutting down the weight of valve box, valve and cradle to the minimum. All these changes make, of course, for increased maintenance costs owing to greater wear and tear and a smaller margin of strength to provide against breakage. We have, therefore, two tendencies, one to produce a simplified and stronger hammer drill, the other to reduce the weight and increase the boring speed of piston drills. The results from the surface trials are, therefore, interesting, and in some cases, surprising.

The Competing Drills

The machines entering the competition were as follows:

(1) Holman drill. Made by Holman Bros., Cornwall; a piston drill, cylinder diameter, 2⅛ in.; stroke, about 5 in.; weight, 99 lb.; spool valve with auxiliary ball valves; rotation, automatic.

(2) Bantam drill. A locally-designed piston drill; cylinder, 2 in. in diameter; stroke, 5 in.; tappet-moved valve; weight, 82½ lb.; automatic rotation.

(3) New Century drill.

(4) De Fries drill. Both these drills were of the light hand-hammer class, weighing about 40 lb., and having no clamp or cradle. The De Fries lacked sufficient boring power; neither were suitable for the conditions of work in this field, having no arm, bar or clamp, or forward feed.

(5) Ross Patent drill. This is also a hammer drill, the design of which appeared quite unsuitable for the work.

(6) Anderson drill. Locally designed, but made in Scotland; a piston drill having a 3-in. cylinder, 5-in. stroke, with air-thrown valve having a regulating device to make up for wear. The machine was also designed for use with water passing down the piston rod, through the hollow steel; automatic rotation.

(7) Vlottmann drill. A well-known German make that has been largely used in coal and metal mining in Europe. Hammer drill; weight, 78¼ lb.; cylinder diameter, 2½ in.; stroke, 2¾ in.; weight of hammer, about 4 lb.; blows per minute, about 1000; valve motion is of the oscillating ball type and rotation is automatic, the hammer carrying a rifle bar; hollow shell with water injection is used; feed was by hand screw and the cradle could be moved forward or back on the clamp.

(8) Westfalia. Another German hammer drill; diameter of cylinder, 2¾ in.; weight, 65 lb. The feed is automatic by an arrangement of two pawls on a ratchet bar. This device is not novel, as supposed, being adapted from an early design of tunnel drill described in Guttman's work on blasting. This machine used a spray and exhausted air down hollow steel. It bored very rapidly, but it seemed doubtful to me if the pawl arrangement would wear well, and if the machine is not too light for its energy output.

(9) Keymer drill. This hammer drill was withdrawn.

(10) New Century OO piston drill. This, with the New Century hammer drill previously mentioned, is a locally invented drill. The spool valve is of novel design; cylinder, 2⅛ in. in diameter; stroke, 6 in.; weight, 92¾ pounds.

(11) Climax Imperial. Hammer drill, made by Stephens & Sons, Cornwall. This drill I have already described in a special article. It is a powerful long-

stroke hammer drill with automatic feed specially designed for work in this field.

(12) Holman 2¾-in. piston drill. Similar in design to the 2⅛-in. drill, and to the Chersen drill.

(13) Murphy drill. Hammer drill of the type well known in America; a valveless machine using hollow steel with a water feed from a detachable clamp attached to drills. Its performance against machines of the valve-moved type with anvil block, such as the Waugh, Vlottman and Climax Imperial, is interesting.

(14) The Konomax stope drill. A piston drill of local design; 2-in. cylinder; 4-in. stroke; weight, 91¾ lb.; feed, entirely automatic. This machine is valveless and gives diagrams of air consumption resembling those of a first-class engine showing the air to be used expansively.

(15) Holgate piston drill. Cylinder diameter, 3⅛ in.; stroke, 4 in. This was a locally designed and manufactured machine and, though it bored up to a rate of 5½ in. per min., it broke down several times, owing to being constructed of unsuitable material.

(16) Siskol. A piston drill using hollow steel and a water jet; water lead in through back of machine and through the piston rod to the drill bit. This machine was a rapid driller, but there was evidence that troubles would manifest themselves underground.

(17) Waugh drill. A hammer drill, manufactured in Denver, Colo. It has, like the Murphy, a rear-cylinder piston air feed and the steel is rotated or oscillated by hand. Air and water are injected down hollow steel. The machine has a hollow cylindrical short-stroke piston valve set at the rear of the cylinder. Vanadium steel is used for the anvil block, and it is claimed that reliability and freedom from breakdown is a prominent feature. The machine is mounted on a swivel cradle so that it "follows the steel" when boring and does not hold it rigid.

(18) Meyer-Fullerton. A hammer drill using hollow steel with air injection; appeared deficient in boring power.

(19) All Steel drill. Piston drill of insufficient power.

(20) Chersen. A piston drill of 2¾-in. diameter; 6-in. stroke; oscillating valves. This drill performed well in the trials organized by the "South African Mines," and has already proved itself a reliable machine, there being upward of 200 at work in this field; ordinary solid steel is employed.

The arrangements for holding the trial were good. Granite blocks, 3½x3½x5 ft. were set in a solid bed of concrete. Bars were solidly erected and connected by rail bolts and clamped to the concrete. Water connections were provided and air was supplied, being carefully measured through a Kennedy air meter, calibrated by Professor Orr, of the Transvaal University College. M. W. Wood acted as manager and the arrangements gave every competitor satisfaction. The accompanying table, taken from the *South African Mining Journal*, gives the results in a tabulated form.

SURFACE ELIMINATION TRIALS IN THE RAND STOPE DRILL COMPETITION.

Name.	No. of Machines Tried.	Average Inches per Min.	Order of Merit.	Cu.Ft. Free Air Used per Min.	Order of Merit.	Cu.Ft. Free Air Used per Foot Drilled.	Order of Merit.	Percentage of Total Time not Occupied in Drilling.	Weight. Pounds.	Dust Allayer.	Type.	Nature of Steel.
2⅛ Holman	2	2.397	15	75.1	12	376.58	11	26.3	99½	*a*	Reciprocating	Solid
*Bantam	3	0.875	19	43.2	4	581.03	18	18.8	82½	*a*	Reciprocating	Solid
*De Fries	2	0.358	21	39.8	2	1,319.00	20	11.2	27½	*a*	Hammer	Hollow
*New Century	2	2.873	10	79.8	13	335.90	10	35.7	34½	*b*	Hammer	Hollow
*Ross Patent	3	0.386	20	86.3	15	2,449.20	21	53.0	61½	*b*	Hammer	Hollow
*Anderson[1]	2	2.482	11	91.5	18	442.30	17	55.4	99½	*a*	Reciprocating	Hollow
Anderson[2]	3	2.532	12	90.5	17	441.25	16	52.2	99½	*a*	Reciprocating	Hollow
Vlottmann	2	4.012	4	64.6	9	193.09	3	42.1	87½	*b*	Hammer	Hollow
Westfalia	2	4.208	2	89.4	16	261.91	8	36.9	65	*c*	Hammer	Hollow
Climax Imperial	2	3.520	5	68.5	10	235.65	5	30.7	97¼	*b*	Hammer	Hollow
2¾ Holman	2	3.110	7	99.9	20	386.55	12	25.7	99½	*a*	Reciprocating	Solid
New Century OO	2	2.271	16	53.4	8	283.85	9	38.1	91½	*a*	Reciprocating	Solid
Murphy	2	2.916	9	40.6	3	169.75	2	35.2	81⅛	*b*	Hammer	Hollow
Konomax	2	2.476	13	29.6	1	144.40	1	29.2	91½	*c*	Reciprocating	Solid
Holgate[1]	2	3.027	8	98.4	19	391.40	13	44.3	96⅞	*c*	Reciprocating	Solid
Holgate[2]	2	3.449	6	112.4	21	393.10	14	29.5	98½	*a*	Reciprocating	Solid
Siskol	2	4.337	1	74.2	11	206.35	4	50.7	95⅝	*b*	Reciprocating	Hollow
Waugh	2	2.428	14	50.6	5	252.65	7	32.3	80½	*d*	Hammer	Hollow
Meyer-Fullerton	3	1.630	17	53.0	7	412.66	15	29.5	73½	*a*	Hammer	Hollow
*All Steel	2	1.027	18	51.6	6	604.10	19	26.7	97⅛	*a*	Reciprocating	Hollow
Chersen	2	4.110	3	81.8	14	239.92	6	31.5	97⅛	*a*	Reciprocating	Solid

*These have been eliminated as a result of the surface trials. [1]First trial. [2]Second trial. (*a*) Used either a dipper or a jet from main provided by the committee. (*b*) Jet through steel. (*c*) Separate spray from main. (*d*) Jet and air through steel.

The Qualifying Drills

The Holman, 2⅛ and 2¾ in., the Vlottmann, Westfalia, New Century OO, Climax Imperial, Murphy, Konomax, Holgate, Siskol, Waugh, Meyer-Fullerton and Chersen drills successfully passed the test of drilling 1 in. per min. and are entered for a further 3-day elimination trial underground. It will be noted that the Siskol piston drill had the best average speed of drilling of all competitors. This is somewhat curious in view of the statements made by certain American manufacturers. Had they been asked if it were possible to build a 100-lb. piston drill to outdrill a 100-lb. hammer drill the answer would have been decidedly in the negative. I do not expect this drill to survive the 6-month trial, but its success confirms my expressed opinion that the ideal piston drill is one using hollow steel with water injection and that its efficiency would approach or surpass that of any hammer drill.

The German hammer drills stand second and fourth in the list, but I do not expect the Westfalia to survive to the finish. The Chersen drill comes third, and this drill, I think, will come very near winning the competition. The Climax Imperial hammer drill stands fifth. This machine should be well up among the hammer drills at the end. The Murphy valveless hammer drill working without an anvil block stands ninth, beating the Waugh, which stands fourteenth. The interesting Konomax, the baby of piston drills, with only a 2-in. piston and a short 4-in. stroke, drilled faster than the Waugh. The two American machines are, however, strong and simple and will, I think, last through the trial.

Air Consumption

In air consumption, the Konomax leads easily with only 29.6 cu.ft. per minute. The Murphy is second with 40.6, beating the Waugh with 53.0. The Siskol stands third with only 50.6. The Chersen is higher, 81.8 cu.ft., but this is not high for a 2¾-in. piston drill. The air consumption per foot drilled is not an exact comparison, but here again a piston drill leads, the Konomax using only 144.4 cu.ft. The Murphy hammer drill, by also using air expansively on the forward stroke, is a good second with 169.75 cu.ft. The Chersen uses 239.9, the Vlottmann 193.1, the Climax Imperial 235.6, the Siskol 206.35 cubic feet.

Conclusions

Generally, it may be said that piston drills have more than held their own, while the valveless type of hammer drills has done well. Personally, I fancy the piston drills will last out the underground trials better, especially if their owners are farsighted enough to supply plenty of spares to keep them efficient, but there are several hammer drills in which most of the sources of weakness of this type have been carefully eliminated, and it is quite possible that the winner may be found in such a drill as the Murphy or the Climax Imperial.

The efficiency of the piston drills will tend to fall as soon as the chucks wear and the drill is not held truly, and as the pistons, cylinders and valves wear, air consumption will increase. Competitors are, however, allowed to repair machines, cost of such repairs being charged against them, and a bold policy in this respect will meet its own reward. Hammer drills may suffer from water leakage, cylinder wear, breakage of hammers and anvils, and must stand the extra expense of hollow steel, water hose and connections. Whatever the result may be, much will have been learned of the greatest value for future designers.

Fuller's Earth

Fuller's earth is an aluminum silicate containing more combined water than most clays; its chemical composition varies with its origin, and is of no value in the matter of determining the commercial qualities of a given sample. The properties and uses of fuller's earth are the subject of an extended article in *La Revue de Chimie Industrielle* which states that while the most common colors are brown and gray, it also occurs white, yellow, pale red, and even black. Its specific gravity ranges from 1.75 to 2.50. The earth will sometimes disintegrate when put under water, but more frequently a piece of it will hold its original shape. Certain earths are hard, like rocks. The best fuller's earths come from Dorset, Kent and Surrey counties, England.

When analyzed by the methods applied to rocks, some fuller's earths show a strongly acid reaction, although entirely free from acids. This apparent acidity arises from its absorptive qualities, and is directly proportional to its power of absorbing such bases as lime; it is not, however, at all proportional to its decolorizing power on oils. The apparent acidity varies from nothing up to the point at which 1.50 per cent. of oxide of lime is required to neutralize it.

Decolorizing and Oxidizing Power

Fuller's earths from certain localities have the unfortunate effect of giving to edible oils a rancid flavor, by oxidation, and this power is directly proportional to the absorbing capacity of such earth. Earths which possess this character to a high degree can be treated with lime-water, to counteract the apparent acidity, but at the same time their decolorizing power will be diminished; it is for this reason that earths high in lime are not good decolorizers. If the above treatment be limited to the partial neutralization of the acidity, the odorizing effect of the earth will be reduced while its decolorizing power will not be entirely lost.

When an earth of high apparent acidity is subjected, under water, to a strong electric current, the particles appear to be negatively charged, and move slowly toward the positive pole; this probably explains the fact that such earths give an acid filtrate after agitation with salt water, and the power of such an earth to remove the nitrogenous colors from an oil, exactly as would be done by a true acid.

Some earths possess a very active oxidizing power on oils; the oxidation is sometimes so violent that the cakes removed from a filter press, after treatment of an oil, will burst into flames from spontaneous combustion as soon as they reach the air. This event is most often noticed when working with rapid-drying oils.

The decolorizing power of fuller's earth has never been perfectly explained; some think that it is a chemical reaction, while others believe it to be purely mechanical. Cameron's experiments seem to indicate that it is merely an absorption, and that it takes place more rapidly in an oil than in a water solution. Practically all the coloring matter taken out of an oil by a fuller's earth can be recovered from the earth by alcohol, provided that the adherent oil is first removed by treatment with ether or benzine. This combined treatment will restore the decolorizing power of a used earth almost completely.

Treatment of Mineral Oils

The decolorizing of mineral oils is conducted in a different way, and with a different quality of earth, than that applied to animal and vegetable oils. For mineral oils, the Florida fuller's earths seem better than the English, and even an important amount of lime is no detriment. The operation is similar to that of clarifying sugar solutions by boneblack, consisting in allowing the oil to filter through a bed of fuller's earth. The first oil to come through will be almost colorless; thereafter it comes through less and less clear, until the filter bed becomes saturated with coloring matter and will absorb no more. The spent earth can then be regenerated by calcining in a rotary furnace; the high temperature to which it is subjected here does not seem to diminish its decolorizing power on mineral oils, though it does with animal and vegetable oils. The fineness of the earth should be adapted to the nature of the oil to be treated; heavy and viscous oils require the earth to be in coarse grains, while with a light oil, the earth can be ground to 200 mesh and over.

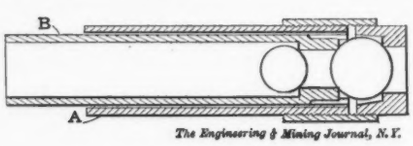
Animal and Vegetable Oils

The method of decolorizing animal and vegetable oils is to heat the oil in a receptacle containing a coil of steam pipe; add the necessary amount of fuller's earth; stir for two or three minutes, and conduct the mixture to a filter press to recover the earth and liberate the oil. The temperature varies according to the nature of the oil and the kind of product desired, but ranges around 100 deg. Centigrade. A lower temperature is often used.

The amount of earth required also depends upon the nature of the oil, and even for different lots of an oil of the same general nature, different amounts of earth will be required to yield a product of the desired whiteness. Lard oil generally requires 1 per cent., by weight, of fuller's earth, cottonseed oil requires 5 per cent., while tallows need very large proportions. The oil refiner selects his stocks of crude material so as to demand the least possible amount of fuller's earth to decolorize it, since he will thus not only economize in the consumption of earth, but will also lose less oil by adherence to the earth.

A Packingless Pump

The abolition of packing between the pump piston or plunger and the cylinder bore is proposed in the arrangement shown in the accompanying illustration. It is a suction and force pump with two concentric cylinders, *A* and *B*, with a certain amount of annular space between them, and each of which is closed at the lower end by a ball valve. In this construction it is intended that the liquid pumped shall play the part of packing between the two cylinders. The pump is especially intended for handling such liquids as muddy or sandy water or petroleum. It is the invention of Mark Pollatschek, of Bukarest.



PACKINGLESS PUMP

In 1908 there were produced in the United States, according to statistics collected for The Mineral Industry, 1,149,000 lb. of bromine ($103,410) against 1,062,000 lb. ($138,060) in 1907.

New Method of Extracting Oil from Boreholes

The Principal Feature of the System Is an Endless Cable Covered with Absorbent Material and Operated from a Drum at the Surface

BY FREDERICK A. TALBOTT*

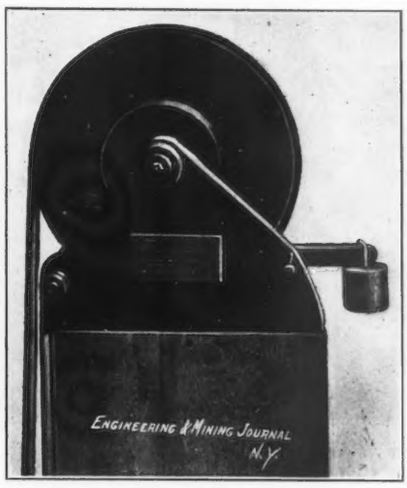
An interesting development in the petroleum industry among the oilfields of Galicia has been effected recently the results of which have been so successful that the principle is being extended throughout this oil-bearing area. Owing to the remote situation of these fields, the lack of highly-skilled labor, and the uncertain yield from the boreholes, the erection and operation of the usual types of pumping plant is attended with numerous difficulties. Repeated efforts have been made to devise simple systems for the extraction of the crude oil from the deep and narrow pits, easily, quickly, and cheaply, in order to suit the local conditions, but the success achieved has been only partial and commercially impracticable for all-round working. As a result of a prolonged investigation of the problem an entirely new system has been devised by Herr Bruno Leinweber, an engineer of Vienna, prolonged tests with which under the most exacting conditions have proved eminently satisfactory. It offers an inexpensive and easy means of extracting the oil from the boreholes and should prove eminently adapted for operation upon oilfields which from their remote situation and other conditions cannot be exploited in the usual manner at a profit. Though primarily devised for oil wells, it is equally applicable to the haulage of any fluids or even semi-fluids such as water and saline solutions thickly impregnated with organic matter.

The Leinweber System

Briefly, the system comprises an endless band or cable, covered on one side with an absorbing material, such as carpet shag, which is of sufficient length to become immersed at its lowest extremity in the liquid in the borehole. As the band travels through the liquid a certain proportion of the fluid becomes absorbed by the covering of the cable which, upon arrival at the surface, is passed between two rollers. These press out the liquid, which can either be caught in suitable vessels or, if the pit is merely being drained, deviated into conduits and thus led away. The plant at the mouth of the borehole comprises a timber staging carrying a drum around which the cable passes, and by means of which it is driven either by hand or other power, guide pulleys to lead the upward and downward traveling sections of the rope to and from the well, and the pressing rollers. It will thus be seen that the apparatus is of simple design and construction. Having few integral parts, it is not easily liable to breakdown.

The First Plant

The first plant was constructed for operation in the Kryg oilfield of the Galician-Carpathian Petroleum Company, the engineer and directors of which, impressed by the possibilities of the system, placed several of their boreholes at the disposal of the inventor for the purpose of practical experiment and demonstration. The plant was built in the railroad shops at Reichenberg, Bohemia, and was packed,



HEADSHEAVE OF LEINWEBER EQUIPMENT FOR SHALLOW WELL

mounted on two channel-frames, with the band properly adjusted, so that it could be erected immediately upon arrival at the oilfields.

In this plant the traveling cable was manufactured especially to suit the prevailing conditions. It was of rectangular construction, being 3.1496 in. wide by 0.31496 in. thick, made of hemp and tested to withstand a strain of 9240 lb. The carpet shag with which the outer face of the cable was covered was 2.3622 in. wide by 0.7874 in. thick and for the purposes of experiment three different kinds were attached to the traveling cable which was of hemp in three sections, the idea being to ascertain which class of shag possessed the greatest absorbent and yielding qualities. The whole was designed for working to a depth of 924 ft. and before despatch to the oilfields the band was severely tested, the ascending part being loaded to the extent of 2200 lb. in excess of the estimated weight of 550 lb., which it would have to withstand in actual use. This was done in order to test not only the cable, but the effect and stresses upon the winding jack which in this instance would have to be hand driven. It was found that the band traveled more smoothly and evenly when saturated with liquid than the descending dry section, since it secured a better adhesion upon the surface of the winding drum. The winding sheave worked steadily and without any accompanying slip or jerk.

First Test of the System

The borehole first selected was near Maryampolski and was 1881 ft. in depth. Only the upper part, however, was in a proper condition for work and this had a diameter of 9 in. Before the band was let down it was stretched out on the ground for measurement and preliminary preparations. Owing to the severity of the weather prevailing at the time of the trials the carpet shag became clogged with snow and was frozen hard when it was lowered into the borehole. Under these circumstances descent had to be made slowly and carefully, the lowering operation, after the two ends had been spliced together to secure an endless band, occupying 1.5 hours. The band was not cleaned, being lowered in its snow-clogged and frozen state, yet it was observed despite these unpropitious conditions to descend vertically and without touching the sides of the borehole. Moreover, as steam drive was unavailable winding had to be carried out by hand, so that a speed of only 0.66 ft. per second could be attained.

Owing to the condition of the carpet shag covering the cable it was some time before it attained its maximum absorbing capacity. The oil containing a large proportion of paraffin, owing to the low temperature prevailing, was of the consistency of fruit jelly. Notwithstanding these adverse conditions, the plant worked smoothly. The average yield obtained at the pressing rollers was found to be 4.13 oz. per foot of cable. This yield might have been increased had the rollers been fitted with skimmers to secure the oil which was brought up on the sides of the cable, and which by descending into the borehole, was lost. Fur-

*13 Wilbury Crescent, Hove, Sussex, Eng.

thermore, owing to the band being fitted with three different qualities of shag the yield varied, since one section was found to be particularly deficient in absorption. With the band traveling at about 5 in. per sec., an oil barrel was filled in 50 min. When, however, the shag became more pliable and a speed of 3.3 ft. per sec. was attained a yield of over 4000 lb. per hour was obtained. At the conclusion of this test the plant was dismantled and reërected at another borehole 1716 ft. in depth, where it is still in service.

Installation at Boryslaw

The preliminary tests having been considered successful, the construction of other plants was commenced for various pits on the oilfield. The inventor, in the first of these which has been erected at Boryslaw, was able to carry out certain modifications in the cable and shag which the experiments at Kryg had demonstrated as being advisable. The pit at which it is in operation is of great depth, the band working down to 2640 ft. The oil is thick and impregnated with from 7 to 8 per cent. of paraffin. The gases are sufficiently rich to cause the well to spout every alternate day when the yield is about 11,000 lb. per day. The cable is of steel wire of rectangular section, about 2 in. wide by 0.157 in. thick, covered with a long-haired pile on the outer surface, 0.78 in. thick. The cable has a breaking strain of 11,176 pounds.

The pit-mouth installation is similar to that erected at Kryg, the hand cranks simply being replaced by a pulley to take the driving belt of the steam engine. When the plant was started it was only found possible to attain a maximum speed of 9.25 ft. per sec., since the steam engine was not sufficiently powerful to drive faster. The average speed, however, was 4 ft. per sec., at which velocity the band yielded 4500 lb. of oil per hour. In this instance also the yield could have been increased if oil-strippers had been provided to secure the contents carried on the sides of the cable, but they were omitted in order to render all parts of the band and machinery accessible and under free observation. It was found that the weight of the ascending oil-laden section of the band was 2024 lb. and that of the descending dry section 1044 pounds.

Unfortunately in this instance the capacity of the plant proved too large for the flowing capacity of the well. Consequently, owing to the oil level in the pit decreasing so rapidly as to interfere seriously with the efficiency of the apparatus the latter was dismantled and transported to another well.

Modification of the System

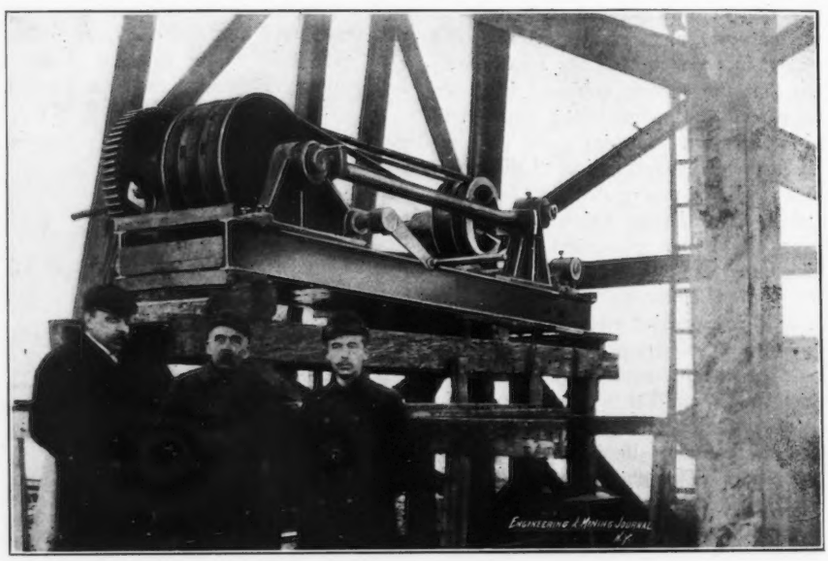
Another installation is being made for the same fields, but a new system will be adopted for the surface plant. It is to work to a depth of 3960 ft. The band will be of the same type and dimensions as that used in the above-described Boryslaw installation. The pit-mouth apparatus will consist simply of a driving disk of large diameter around which the endless cable will run together with a pulley guide and a pressing roller. The experience gained at Boryslaw proved that although the existing plant is simple in design and working it might be made still simpler with corresponding advantages. The inventor will, as a matter of fact, revert to the system he first evolved in the course of his model experiments, the principle of which is shown in the accompanying illustration of a small plant working to depth ranging from 100 to 130 ft., constructed especially for the Technical High School at Carlsruhe, Germany. In this it will be seen that the driving sheave comprises a narrow wheel carrying two or three winds of the rope. It is mounted upon a small frame, the ascending section of the band passing through the pressing rollers mounted immediately below the axis of the driving wheel. This arrangement certainly possesses the advantages of being much simpler, while it occupies much less space and is more readily accessible. The plant devised in accordance with this principle will be utilized in connection with boreholes having depths of 4125, 4412 and 4468 ft., respectively.

Adaptability and Repair of the Plant

The efficiency of the system and its suitability to such conditions as prevail in the Carpathian oilfields, has been proved. The distance of the field from the industrial centers renders a breakdown a serious matter, since some time must unavoidably elapse before it is possible to secure duplicate parts or repairs. On the other hand, the Leinweber plant can be easily repaired should an accident occur. When in operation no attendance is required beyond the charging of the lubrication cups on the bearings.

The two sections of the band, before one part becomes soaked, balance each other so that the driving effort required is only that necessary to deal with the weight of the material being raised and the slight frictional losses. The band can be kept in a constant state of repair and efficiency. Should a stretch of the shag become worn, it is necessary only to remove the defective part and sew on another piece, it not being necessary to withdraw the band from the borehole for this purpose. When it is desired to remove the band, the splicing is simply released and one end made fast to the winding sheave or paid out and coiled as the drum brings it up.

The system is flexible and the traveling speed and consequently the yield can be controlled within a wide range; similarly the dimensions of the shag can be increased or decreased as occasion requires. The system is especially suitable to those boreholes which are not carried down vertically since there is always a certain tension between the drum and the lower bend in the band due to the weight of the absorbed material, while experience has proved that none or very little loss in yield arises from the band striking the side of the borehole. Should the band encounter any obstruction in its course a safety clutch can be fitted to the winding sheave to bring the machine to a stop and thus avoid any breakage of the traveling band. In the event of the oil containing water, the liquid upon exuding from the pressing rolls can be separated, while similarly should the oil be combined with sandy material the latter can be removed by a water jet or steam flush.



LEINWEBER OIL EXTRACTION EQUIPMENT AT KRYG, AUSTRIA

Although the exploitation of the invention has hitherto been confined to the Carpathian oilfields, its operation has been inspected by several engineers to whom its simplicity and immunity from breakdown has appealed. Arrangements are now being concluded for its development in other parts of the world where local conditions are not suitable to the utilization of the generally adopted facilities for such work.

Occurrence of Auriferous and Stanniferous Tourmaline in Sumatra

By L. Hundeshagen*

Some years ago I noted a peculiar rock consisting entirely of small rounded grains of quartz and cemented by talc about 2 to 3 km. to the southwest of Moeara Sipongi (residency of Tapanoeli, west coast of Sumatra) and in other localities of the neighborhood.

The rock carried small quantities of dark yellow gold and has occasionally been mined for gold by Malays. It rests on granites and is from 30 to 100 m. thick, being in places overlaid by more or less metamorphosed sandstone which consists mainly of quartz and feldspars and is in places intersected by diabasic dikes and sills. The capping of quartz-talc rock is probably a metamorphosed granite. It appears that a similar rock has not yet been mentioned as occurring in other parts of the world.

As regards the gold, it is not accompanied by sulphides, but it incrusts occasionally a blue-black nonmagnetic iron mineral not yet exactly determined. In the zone of quartz and talc, more especially where near diabasic rock, occur pockets and irregular masses of almost pure black tourmaline free of sulphides and with traces or no limonite. The magnetic segregations of crystallized tourmaline assay from 2 to 10 dwt. gold and a little silver, part of which is succeptible of amalgamation. Though the tourmaline is in places 2 ft. thick, it is not certain whether it can be profitably mined. Boulders of tourmaline, which mineral, as is well known, is very characteristic of the stanniferous deposits at the Straits Settlements and elsewhere, were found in 1901 by the government mining engineer about 30 to 40 km. northeast and east of Loeboe Sikaping (Uplands of Sumatra) where stream tin is being won by the Malays. Though this tourmaline, when finely crushed, rarely pans cassiterite, it at times assays, according to his report, appreciable quantities of tin, viz., a small per cent., and exceptionally even up to 10 per cent.

*Heerengracht 159, Amsterdam, Holland.

Dredging Conditions in Colombia

By A. P. Rogers*

Colombia offers today several attractive features for gold-dredging operations, although the drawbacks should be well understood before anyone attempts to invest his money there. I spent several months upon a thorough examination, which resulted favorably, of a piece of land in that country and as far as I know, it is the first expedition ever sent down there that has drilled the ground in the systematic manner that such work is done in California and other established fields. The successful operation of a dredge upon this land will be watched with much interest, and it is bound to prove a stimulus to other similar projects within a short time, when the work of equipment has been completed and the extraction of the gold has actually begun.

The conditions under which one must work are radically different from those found in the United States. This land is all situated within 10 deg. of the equator, and most of it is at an elevation above sea level which is considered unfavorable to health in that latitude. The climate is tropical in every sense of the word, while the heavy and violent rainstorms during the wet season —lasting nearly nine months of the year —turn the flat areas, suitable for dredging, into veritable swamps which breed the malaria-infected mosquito by the million. To guard against these pests requires a strong constitution and a sane manner of living, which the Northern man is loathe to adopt until he has gone through the mill.

A tropical jungle that is exceedingly dense and a cause of much annoyance must be cleared off most of the land. It must be understood that this country is very sparsely populated, and practically the only means of travel is by the large navigable rivers, or over frightfully rough and uncertain trails, blazed through long stretches of impenetrable wilds. Small settlements exist at intervals along the rivers, but behind them there is always the jungle until another river is reached. As a consequence, the traveler must carry his own camp equipment and food supplies upon any journey he intends to make into the interior, and a plentiful supply of netting to keep away the insects at night.

The gold content of the ground is often high enough to prove very attractive for dredge mining, especially when it is taken into consideration that you can work throughout the year with no fear of an interruption due to cold weather. The only thing one must guard against is the chance of a heavy flood, if the dredge is working on a river. Such an occurrence is liable to happen at any time during the wet season, and occasionally during the dry season, with great rapidity, and produce startling results. For this reason, it is preferable to work inland a short distance, where it is possible.

The gravel usually contains a small percentage of clay, but in most places this is not so much of a hindrance as the lack of uniform values. It is the usual thing for the owners to claim phenomenal values throughout their land, which must always be taken with a grain of salt. Rich spots are quite common, but their extent is usually rather limited, and one must discount these statements when a large area is figured on. There are so many rivers in this region flowing down from the upper Andes, that sufficient water power can be developed in numerous places for all the dredges that are ever likely to be installed, although one may have to go some distance from his ground to find the most suitable location for a power house.

The conditions under which the men must live are very trying in some respects. A Northerner going there for the first time should exercise the same precautions he would take if he lived in a swampy region here at home during very warm weather. All houses should be built off the ground upon some hilltop, have high ceilings with a double roof, and wide verandas. By clearing away the jungle from about the house, the warm sun will dry things up and a chance will be given to any breeze that may spring up. The soil over these low areas is exceedingly rich and fertile, so that a large variety of vegetables can be raised at your very door, while cattle seem to thrive. To prepare the food, an imported cook is a necessity, as the native knows nothing about this important art. To keep good men contented in such a country nothing pays better than to set an attractive table.

The government of Colombia is now considered fairly stable and it is anxious to help all legitimate mining enterprises as much as possible. There is an export tax of 1 per cent. upon all gold exported from the country, but mining machinery is practically free from duty. As far as labor goes, it is fairly efficient, for the wages that are paid. The peon is much like a small child and will work to the best of his ability, if treated properly. Probably the most difficult problem to solve for a foreign company, operating in this field, will be to secure the services of an efficient and honest corps of our countrymen to keep things going. It is a long way from home and the average man is apt to get homesick, if not really sick, and then his principal thought is how to get back North with the least possible delay. This condition of things necessitates a reserve corps to fall back on when the occasion arises. In spite of the drawbacks, I look to see considerable capital invested in dredging enterprises in Colombia within the next few years.

*Mining engineer, 52 Broadway, New York.

Improvements in the Treatment of Slime by the Vacuum Filter Process

By Arthur W. Allen*

The idea of simultaneous displacement of pulp with wash solution in the working of a suspended-leaf type of vacuum filter was formulated and put into practice by me at the Palmarejo & Mexican Goldfields Company's slime plant at Zapote, Mexico, some months ago. The success that has resulted has given rise to the following description of what would be the most satisfactory type of installation on this system.

CHART OF OPERATIONS FOR VACUUM FILTER PROCESS.

Time.	Compartment No. 1.	Compartment No. 2.	Compartment No. 3.
1:55	Solution into No. 2.	Pulp into No. 3.	CHARGE 64.
2:05	Replaced by water.	Replaced by solution from No. 1.	.....
2:15	Vacuum off.	.....	Pulp agitated with pump.
2:20	.....	.....	Vacuum on.
2:25	Cake discharged.	.....	.....
2:30	Gate closed.	.....	.....
2:35	CHARGE 65.	Solution into No. 3.	Pulp into No. 1.
2:45	.....	Replaced by water.	Replaced by solution from No. 2.
2:55	Pulp agitated with pump.	Vacuum off.	.....
3:00	Vacuum on.	.....	.....
3:05	.....	Cake discharged.	.....
3:10	.....	Gate closed.	.....
3:15	Pulp into No. 2.	CHARGE 66.	Solution into No. 1.
3:25	Replaced by solution from No. 1.	.....	Replaced by water.
3:35	.....	Pulp agitated with pump.	Vacuum off.
3:40	.....	Vacuum on.	.....
3:45	.....	.....	Cake discharged.
3:50	.....	.....	Gate closed.
3:55	Solution into No. 2.	Pulp into No. 3.	CHARGE 67.

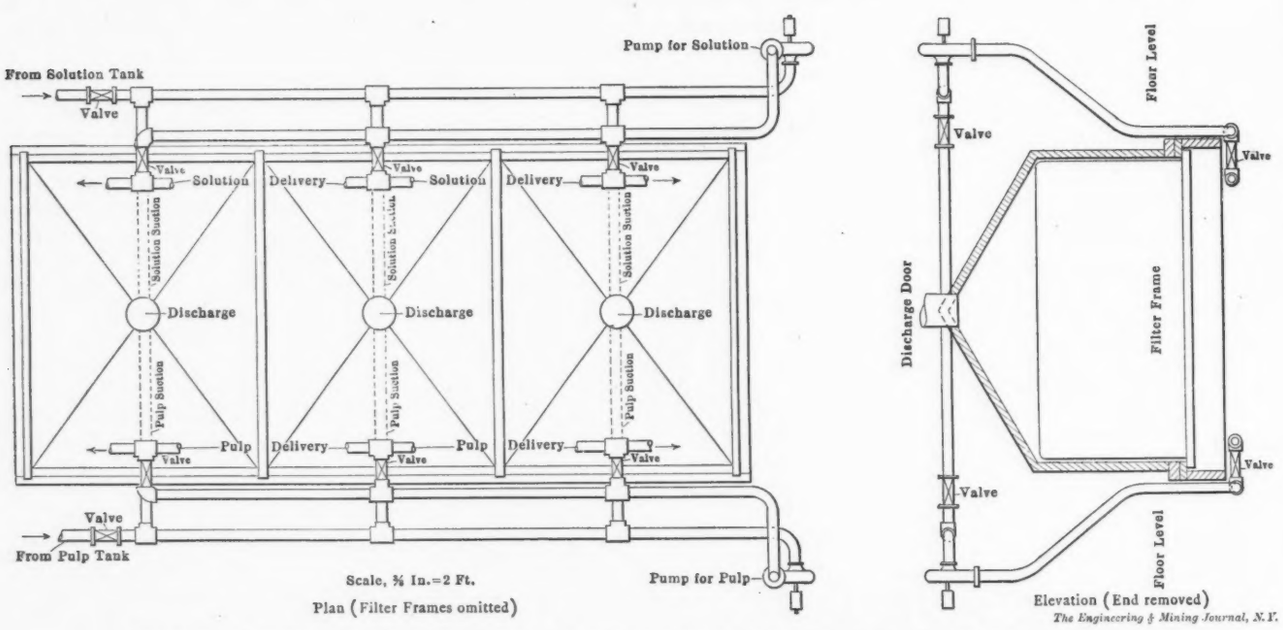


DIAGRAM OF FILTER SHOWING CONNECTIONS FOR SIMULTANEOUS DISPLACEMENT METHOD OF SLIME TREATMENT

The attached plans are diagrammatic and, for the sake of clearness, the water and vacuum pump connections have been omitted. The filter box consists of three separate compartments each having a discharge door and each containing an equal number of filter leaves. These latter are connected with a vacuum pump in the usual way and arrangements are made so that the vacuum in any particular compartment may be lowered or shut off.

There are two systems of pumps. The one, which is used for pumping pulp from the bottom of either of the compartments into the top of either of the others, is also connected with the main agitation or storage vats. The other, for solution, is connected with the compartments in a similar way on the other side of the filter, and also with the solution pumps. Both the solution and pulp are delivered over the full width of the compartment by means of perforated canvas hose.

The cycle of operations is as follows: The first compartment is filled with pulp and, when ready, the vacuum is applied to the leaves and maintained until sufficient cake is formed. The vacuum is then lowered to a few inches and the pumps are started, the pulp being pumped into the second compartment and replaced at the same time with solution from the third. While the washing is being continued in the first compartment the vacuum is opened to the leaves in the second. When the cake is formed on the latter the pulp is pumped into the third compartment and is replaced by solution at the same time from the first compartment, the latter in its turn being filled with water. As soon as sufficient of this has been drawn into the cake to displace the solution the vacuum is shut off and the slimes are discharged. The gate is then closed and the compartment is ready for the pulp from the third compartment.

The accompanying chart is a complete section of a working sheet and will give some idea of the time taken by the various operations and the economy effected in this direction.

The advantages of the system are: (1) Large tonnage handled in a minimum time. (2) Minimum pumping. (3) Even deposition of sandy matter in cake as a result of top delivery of pulp. (4) Absence of necessity of removal of loaded leaves during operations with consequent jarring of the frames and cake. (5) No drying or exposure of the cake to the air and in consequence no disarrangement of what might be called the molecular deposition of slime particles on the leaf, the practical result of which is a perfect wash in a minimum of time and with the aid of a few inches of vacuum only.

*Metallurgist, Chinipas, Chihuahua, Mex.

The Custom House returns published in the *Viestnik Finanssoff* (*Chem. Trade Journ.*, April 17, 1909) gives the exports of cement from Russia during 1908 as 1,096,000 poods, valued at 465,000 rubles, as compared with 4,417,000 poods, valued at 1,791,000 rubles in 1907.

A West African Gold Mine

SPECIAL CORRESPONDENCE

The report of Prestea, Block A, for the year ended Dec. 31, 1908 will be of interest not only to the shareholders, but to a wider circle who invested in West African mines during the recent boom on the expectation that under new management and with new methods, great improvements would be brought about in the financial results. On examining the report and accounts of the Prestea Block A Company it is evident that the improvement expected has not yet been realized. During the year 1908 the ore milled was 89,933 tons from which gold to the value of £154,763 or 34s. 5d. per ton was recovered. During 1907 the tonnage crushed was 78,164 tons yielding £195,837 or 50s. per ton. There has consequently been a great falling off in the grade of ore milled. An examination of the working costs is equally unfavorable. In spite of the fact that 10 more stamps were running in 1908 than in 1907 and that a reduction in the grade of somewhere about 30 per cent. was made, changes which might by themselves be expected to make a considerable reduction in the costs quite apart from the benefit of improved management, the costs, if compared carefully, do not reveal any marked improvement. The figures given in the reports for the two years are as follows:

	1907.	1908.
Tons milled	78,164	89,933
Stamps	50	60

	Cost per Ton Milled.		Cost per Ton Milled.	
Mining	16s.	3.4d.	17s.	4.64d.
Milling	11s.	3.1d.	10s.	5.57d.
General exp. mine	3s.	11.8d.	3s.	1.34d.
Development	3s.	11.3d.	1s.	1.11d.
General exp. London.	1s.	8.2d.	1s.	2.16d.
Depreciation	..	.....	2s.	7.51d.
Total	37s.	1.8d.	35s.	10.33d.

In the 1907 accounts no charge was made for depreciation and if this item is, for purposes of comparison, deducted from the 1908 figures, the net result shows a reduction in 1908 over 1907 of about 4s. per ton. This is worth having, but it appears to be a fictitious rather than a real improvement, as about 3s. of it is obtained under the heading of development. No doubt the reduction in grade must have reduced automatically the cost of development per ton, but it appears questionable whether the charge made of 1s. 1d. in the 1908 statement of costs is a fair one, especially when the balance sheet shows mine development standing at £182,770 for ore reserves of 270,500 tons or a cost of over 13s. per ton. While no great improvement in the working costs is as yet visible, notwithstanding the great reduction in grade, it is fair to point out that the alterations of plant are not yet complete and that next year's returns may have a more favorable appearance. New ore-bins and crusher stations are in course of erection, as well as a suction gas plant. Before the close of this year it is hoped to be able to treat 14,000 tons per month. It is anticipated too that in the near future the branch railway connecting the mine with Tarkwa will be completed, and that will enable the work to be carried on more economically than at present. In the mine no sinking has been done during the year owing to trouble with water, but new electric pumps are being installed and it is the intention to sink during this year a further 300 ft. vertically in order to open up a sixth and seventh level. At the same time the eastern section of the property will be developed through the new incline shaft. The developments have been of a satisfactory nature, the ore reserves blocked out on March 31, 1909, being 270,500 tons of a value of 11.6 dwt. The company has already contracted a loan of £35,000 and further funds will be required for the equipment of the property and for development of the mine, so that the shareholders may have to wait some time before the dividend-paying stage is reached.

Fires in the Geological Survey Building

SPECIAL CORRESPONDENCE

A fire which occurred on the fourth floor of the Geological Survey building, in Washington, early on May 9, and resulted in the destruction of one of the laboratories of the Survey with a loss of at least several thousand dollars, has again directed attention to the unusual risk the Government is running in keeping records, valued at more than $5,000,000 in a building that is not fireproof. While the Survey officials estimate $5,000,000 as the value of these records, their destruction by fire would mean a total loss of $10,000,000, as the Government has already spent $5,000,000 in obtaining them, and it would be necessary to spend a like amount to replace them, and even then, certain records could not be duplicated under any circumstances.

The fire which was kept from spreading to the remainder of the building, owing to its discovery by an outside watchman and the prompt work of the firemen, is the third that has occurred in this building within the last six years. On Dec. 27, 1903, fire started on the sixth floor in the night time, destroying Government property to the extent of $10,200. On Dec. 16, 1908, another fire in the night on the fifth floor resulted in a loss of $15,810. In both instances, the presence of Survey officials, in addition to that of the night watchman, contributed to the prompt extinguishment of the fires with comparatively small losses.

Shortly after the second fire, James R. Garfield, then Secretary of the Interior Department, sent a communication to Congress, urging an appropriation of $2,500,000 for a fireproof building to be occupied by the Survey, the General Land Office, and the office of Indian affairs.

On April 19, of this year, Senator Guggenheim, of Colorado, presented a bill providing for the erection of a building to be used exclusively by the Geological Survey, the cost not to exceed $1,100,000. This bill is still pending. Survey officials believe that even before a fireproof building can be erected for the general use of the Survey, some small fireproof building should be provided at once for the various laboratories, as these are generally supposed to be the danger spots in the present building.

It is said that the fire in the laboratory on May 9 was caused by spontaneous combustion.

Esperanza

SPECIAL CORRESPONDENCE

The English company holds 449,800 shares out of a total of 450,000 shares in the American Esperanza Mining Company, so that the two companies are practically identical. The property is situated at El Oro, Mexico, and has up to the end of 1908 given a production of 49,114,860 pesos (Mexican currency) from the treatment of 1,176,117 metric tons dry weight. During the year 1908 the mine produced 145,451 dry metric tons of ore, having a gross value of $2,146,290 (U. S. currency), from which a net operating profit of $927,616 was obtained. The average yield per dry metric ton was $14.75 as compared with $20.63 in 1907. The operating costs for the year amounted to $8.48 per ton, which is approximately 17 per cent. lower than the costs in 1907. Considerable additions in the shape of tube mills, Pachuca tanks and Merrill filter-presses are being made to the mill and it is expected that the new improvements will be started in July, 1909; and that increased mill recoveries and reduced operating costs will result. A paragraph in the report that requires some explanation is that which says that the improved milling scheme, as compared with present practice, will increase operating profits by $1,000,000 by reduction of operating cost and increased mill recoveries for mine ores and recovery of values from dumps. It is not clear what tonnage this refers to and whether or not it is allowed for in the estimated operating profit from the ore reserves mentioned above, namely $2,117,222. The report is accompanied by an admirable set of plans together with full statistics of the metallurgical work.

Colliery Notes

Never fire a shot in a hole containing a cavity or break; there is a possibility of firedamp being present in the cavity, and if charged and fired, it may lead to disaster.

In firing shots, separate examinations for gas should be made after each hole has been fired. The position of all holes should be marked previous to firing, so that in case of a missfire, the relieving hole can be placed in a proper position.

According to the latest information, the Canadian-Northwestern coalfield contains over 45,000,000,000 tons of marketable coal. The product of this field, especially in the Fernie district, produces a good quality of coke, which, with improved methods of manufacturing, will equal the coke produced in many American fields.

It is interesting to observe that, although coal-cutting machines were introduced in Great Britain 50 years ago, in 1902 there were only 166 machines used in that country, while in 1907 there were 1493. In the United States in the year 1906, there were 10,212 machines in use, and the percentage of the total coal mined by machinery was more than 30 per cent. Each machine used in the United States showed an average annual production of 11,638 tons, which compares with 8630 tons in Great Britain.

Notwithstanding that public opinion is to the contrary, pit ponies in most districts are well treated. Although the animals fret for a few days when first consigned to the lower regions, they soon regain their natural gaiety and spirit. The ponies are regularly fed three times a day and groomed twice. Their feet and general physical condition are carefully looked after and attended to by experienced farriers. At all well-regulated mines, any cruelty to ponies on the part of the boys who work them is speedily punished. At many English collieries, an admirable plan is adopted, whereby the driver boys are encouraged to attend their ponies properly by the distribution of substantial rewards.

Some attention was attracted in one of the English coalfields, by the withdrawal of a pit pony from active service in a mine, after having been underground continuously for nearly 20 years. When the little animal was brought to the surface, he was stone blind, but otherwise in remarkably good condition. As is the custom at this colliery, the animal was killed, because there was no old-age pension awaiting him. In this and other adjacent mines, it is stated that many of the ponies are employed continuously underground for from 15 to 20 years without seeing daylight. It seems that after so many years of faithful service, mine owners should be able to devise some means for providing for these animals, even though (as it is claimed), the ponies are now painlessly despatched.

One important reason for regarding a mine's atmosphere containing blackdamp with suspicion, is the effect this mixture has on the miner's ability to detect firedamp, should this latter gas also be present. It is well known that the detection of firedamp is affected by the presence of blackdamp, and it is, therefore, important that a strict observance of a fixed blackdamp standard should be adhered to. It is a matter of common knowledge that in some instances, it is possible to have a mixture of blackdamp and firedamp, lighter than air and settling up in the roof. When a lamp is put into such a mixture, the light is immediately extinguished without any indication of firedamp. At such a point, the blackdamp renders the firedamp inexplosive, but if the mixture is given more oxygen, an explosive atmosphere soon exists.

The longwall system of mining is becoming more and more used in Continental coal mines. European engineers contend that longwall mining reduces mineral losses to a minimum, and affords better facilities for the application of mechanical power; this latter assertion is based on the fact that the longwall system presents a continuous working face, extending several hundred yards in length, which simplifies the working of a mining machine, to the one operation of undercutting the exposed seam; subsequently admitting of its easy cleavage by hand. It is also asserted that the longwall system as used in Europe lends itself to a more expeditious transit of the mineral by means of coal conveyers, since temporary tracks are readily laid along the entire length of the working face, and the coal is often broken down into the waiting receivers, effecting a net saving of from 12 to 15c. per ton on all coal brought to the surface under such conditions.

It is a question of dispute as to what percentage of firedamp, when present in mine air, justifies the withdrawal of the men working underground. At a majority of the collieries on the Continent the miners are withdrawn when 2 per cent. of firedamp is found. Regarding a standard as to contamination of the air with blackdamp, about the only sensible practice is to limit this standard to a condition where the lamp becomes dim. When such a decrease in the lighting power occurs, it is then time to withdraw all men. This standard should, therefore, be placed at about one per cent. of CO_2 and not less than 19 per cent. of oxygen. Every miner should always be able to rely on his lamp, and when this latter goes dim, it should be an immediate signal for exit. When blackdamp is present and a miner does not heed the decrease in lighting power of his lamp, it is certain that such an atmosphere will soon dull the miner's senses, and will make him less alive to the ordinary precautions respecting his own safety.

One of the important points brought out at a recent meeting of coal-mining men was with reference to the general tendency of attributing most of the recent mine explosions to coal dust as the destructive agent. A number of engineers now claim that the coal-dust theory is being brought in to explain explosions that are due to gas. Attention was called to the fact that in a number of recent cases, the miners, evidently realizing that something had gone wrong in the mine, were trying to escape by rushing to manholes when a second explosion occurred and killed them. First of all, there was an explosion caused, probably, by the firing of a shot, and a second explosion, accompanied by the production of a partial vacuum, ensued after a short interval. The general opinion was, that the second explosion was due to gas and was more disastrous than the first. One investigator called attention to experiments made in a gallery of boilers, where the real damage was caused by a detonation where there was an open end to the gallery, only three boiler lengths away. In explaining the results of this experiment, the speaker said that when the first explosion had taken place, carbon monoxide was left behind, and in this particular instance, the carbon monoxide was detonated.

It is not advisable to place too much reliance on the safety resulting from watering a coal mine. In an examination of various collieries on the Continent where the practice of sprinkling was carried on, it was found that after an explosion, several districts of a wet character contained the largest quantities of charred dust. In this connection, it may be stated that it is necessary in sprinkling underground, to consider carefully what degree of saturated air a miner can stand. This latter point remains a matter of dispute, for some engineers claim that if the air is dry, a miner can stand 90 deg., while other authorities assert that a man cannot work in 87 deg. of saturated air without injury. Mr. Ashworth, in a recent lecture, argued that to use water effectively as a preventive of explosions, there must be 5 per cent. of vapor present in the air, and that this amount could only be obtained by means of steam. Mr. Ashworth continued by saying, that to get any safeguard in a mine from water, the men must be prepared to work in steam. He suggested that the superintendents make their roads right and the mines sanitary, giving the men as dry air to work in as possible, and never mind watering. This objection to watering on the part of Mr. Ashworth is rather unexpected, in view of the favor that has lately attended the practice of sprinkling.

THE ENGINEERING AND MINING JOURNAL
Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROBERT MCKEAN, Sec'y.
505 Pearl St., New York.
London Office: 6 Bouverie Street, London, E. C., Eng.
CABLE ADDRESS "ENGMINJOUR, N. Y."

Subscription, payable in advance, $5.00 a year of 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii or the Philippines. $6.50 in Canada.

To foreign Countries, including postage, $8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York office in every instance.

Advertising copy should reach New York office by Thursday, a week before date of issue.

For sale by all newsdealers generally.

Entered at New York Post Office as mail matter of the second class.

CIRCULATION STATEMENT

During 1908 we printed and circulated 507,500 copies of THE ENGINEERING AND MINING JOURNAL.

Our circulation for April, 1909, was 43,000 copies.

May 1	12,000
May 8	10,000
May 15	10,000

None sent free regularly, no back numbers. Figures are live, net circulation.

Contents

PAGE

Editorials:
The Price for Copper in 1908 1007
The Cost of Silver-Lead Smelting 1007
The Geological Survey Has Another Fire 1008
The Copper Statistics 1008
The Missouri Geological Survey 1008
*The Diamond Bearing Highlands of Bahia—I ..... *J. C. Branner* 981
Tonopah Mining Company of Nevada ... 986
Silver-Lead Mining in Freiberg, Germany ..... *Wilton G. Brown* 987
*The New Oilfields in Utah. *A. P. Rogers* 989
The Distribution of Transvaal Gold. *Special Correspondence* 990
*A Crude but Efficient Sample Grinder. *A. Livingstone Oke* 990
*Dredging at Butte ..*A. Floyd Bushnell* 991
Instituto Mexicano de Minas y Metallurgia 992
Screening at the Utah Copper Mill. *H. B. Lowden* 992
*A New Coal Washery in Michigan. *Lee Fraser* 993
Notes on the Norton Hill Colliery Explosion ..... *H. M. Morgans* 994
The Oxidation of Coal ..*O. Boudouard* 995
Round Mountain Mining Company 996
Vanadium in Peru ..... *S. Jochamowitz* 996
Topographic Engineering. *W. D. Blackburn* 997
*Surface Trials in Rand Stope Drill Competition ..... *Eustace M. Weston* 998
Fuller's Earth 1000
*A Packingless Pump 1000
*New Method of Extracting Oil from Boreholes ..... *Frederick A. Talbott* 1001
Occurrence of Auriferous Turmaline and Stanniferous Turmaline in Sumatra ..... *L. Hundeshagen* 1003
Dredging Conditions in Colombia. *A. P. Rogers* 1003
*Improvement in the Treatment of Slime by the Vacuum Filter Process ..... *Arthur W. Allen* 1004
A West African Gold Mine. *Special Correspondence* 1005
Fires in the Geological Survey Building. *Special Correspondence* 1005
Esperanza ..... *Special Correspondence* 1005
Colliery Notes 1006
Metallics 1010
Correspondence and Discussion:
Tonnage Estimation in Dumps, Open Cuts, etc ..... *B. H. Case* 1011
Alumina in Copper Blast Furnace Slags ..... *Harley E. Hooper* 1012
Zinc and Sulphur in Mexico 1012
Separating Metals in Solution 1012
New Publications 1013
Personals, Obituaries, Societies and Technical Schools 1014
Special Correspondence 1015
Mining News 1018
Markets 1023
*Illustrated.

The Price for Copper in 1908

As in previous years we summarize herewith the reports of the Lake Superior copper-mining companies as to the amount of copper sold by them in 1908, the receipts for the same and the average price realized. The list is practically complete for Lake Superior with the exception of the Calumet & Hecla, which does not report its average price. All of the other Lake Superior companies are characterized by the fullness of detail that they communicate to their stockholders.

From the reports for 1908 it appears that the various Lake companies realized a remarkable uniformity of price, the averages of the majority falling between 13.3 and 13.4c. per lb. As in 1907 the Quincy realized the highest average. It is to be remarked, however, that the Quincy figure includes the net proceeds of the silver separated, which is not itemized in the report for that company. Aside from that the high price for the Quincy copper is easily explained by its exceptionally high quality and large number of steady customers who buy it without much regard to the competitive offering of other brands of copper. The low average received by the Victoria may be explained by the small amount of its sales, the bulk of which may have been effected during a period of the year when the price for copper was lower than the average.

Speaking generally, 1908 was nearly a normal year, i.e., there was a steady sale for copper throughout the 12 months. Consequently, as is usually the case, under normal conditions, the average actually realized by the producers came very close to the quotational average of the ENGINEERING AND MINING JOURNAL. Fifteen Michigan companies sold 125,949,248 lb. of copper for $16,907,498, an average of 13.348c. per lb. The average of our daily quotations was 13.424c. per lb. Comparison for a series of years is made in an accompanying table.

In 1906 and 1907 the producers fell far short of realizing the quotational average. This was because the conditions in those years were so distinctly exceptional. A repetition of them, or anything nearly like them, may not be seen in another 20 years. In 1906, the price for copper was boosted to the extraordinary figure of 26c. per pound. The latter part of the rise occurred on comparatively small sales which the producers, having disposed of the larger part of their output lower down, failed to realize extensively, wherefore they were outstripped by the quotational average. On the other hand in the precipitous decline of the second half of 1907 the quotations were again established by comparatively small sales and the producers were unable to effect large transactions until the market was near the bottom. In normal years like 1905 and 1908 the weighted average and the quotational average agree very closely.

SALES BY LAKE COMPANIES IN 1908.

Company.	Copper Sold, 1908.	Receipts for Copper Sold, 1908.	Average Price per Lb. of Copper Sold.
Ahmeek	5,788,890	779,130	13.46 c.
Allouez	3,047,051	406,753	13.349c.
Baltic	17,724,854	2,375,440	13.39 c.
Centennial	2,196,377	294,165	13.393c.
Champion	17,786,763	2,381,137	13.39 c.
Franklin	2,962,018	396,580	13.389c.
Isle Royale	2,788,852	370,596	13.29 c.
Mass	1,766,930	238,609	13.50 c.
Michigan	3,000,206	399,186	13.305c.
Mohawk	10,295,881	1,382,731	13.43 c.
Osceola	19,815,046	2,654,140	13.39 c.
Quincy	20,600,361	2,796,230	13.56 c.
Tamarack	11,091,254	1,485,500	13.39 c.
Trimountain	6,034,908	810,755	13.43 c.
Victoria	1,049,857	136,546	13.005c.
Total	125,949,248	16,907,498	13.348c.

AVERAGE PRICE REALIZED FOR LAKE COPPER.

Year.	Sales Reported.	Price Per Lb.	Quotation.
1905	82,372,955	15.597	15.699
1906	113,411,645	19.146	19.616
1907	66,316,025	18.043	20.661
1908	125,949,248	13.348	13.424

The Cost of Silver Lead Smelting

In the JOURNAL of Aug. 15, 1908, we published an article which aimed to show by scientific deduction what is the average profit realized per ton of ore smelted by the American Smelting and Refining Company, a figure that it has always carefully kept out of its official reports. In that article it was deduced that the total profit in the year ending April 30, 1903, was a little less than $2.20 per ton, and the opinion was expressed that the profit in smelting alone, properly considered, at that time might have been about $2 per ton. Since then the company has thrown some light upon the subject. In a recent statement to the New York Stock Exchange it said that the average amount of ore smelted is 3,500,000 tons per annum,

which alone does not afford the basis for any precise calculation. However, the latter is obtained in the statement by Mr. Brush, of the company, before the Ways and Means Committee, Dec. 16, 1908, that in the fiscal year ended April 30, 1908, the company smelted 3,372,750 tons of ore. The net profit in that year was $7,011,191. Consequently the total profit per ton of ore was a little less than $2.08. The actual smelting profit was, of course, something less, because the company realizes more or less from its various ventures that are not to be referred directly to its smelting business. Mr. Brush, in his testimony, several times mentioned $1.50 per ton of ore as being the profit in smelting, in which he may, in speaking offhand, have somewhat underrated the figure. However, the evidence is quite sufficient to prove the accuracy of the deductions that were made in the article in the JOURNAL above referred to.

The Smelting Company and its officers now having told so much, we see no reason why hereafter it should not incorporate a specific statement upon this point in each of its annual reports. We are sure that such a statement would be appreciated both by the stockholders of the company, who are fully entitled to such information, and to the producers of ore with whom the company does business. The stockholders would have a better line upon the position of the company than they can unravel from pages of mysterious figures, while the mine owners would be satisfied that the company is not exacting from them smelting charges that are exorbitant and unreasonable.

The Geological Survey Has Another Fire

The following is a recent newspaper despatch:

"Washington, May 9. For the second time within three months fire threatened with destruction today the building in which the Geological Survey is housed. The blaze was discovered early this morning, and after a sharp fight was extinguished, not, however, until the chemical laboratory was destroyed. It is not known how the fire originated, but it is practically certain that crossed electric wires were the cause of the trouble, as they were of the blaze three months ago. Valuable maps and charts stored in the building were again damaged by water. The frequency of these fires will be taken as an argument for a Government building for the Geological Survey. The building it now occupies is rented, and is a fire trap. In the case of a sweeping fire the Government would lose a vast amount invested in data and much of it could not be replaced."

We have repeatedly urged Congress to eliminate this danger by providing the Geological Survey with an adequate building. Inasmuch as it appears unwilling to do so, we recommend that the President by executive order transfer the Survey and its archives to Fortress Munroe, or some other safe place that the Government may happen to own.

The Copper Statistics

The report of the Copper Producers Association for April is of a nature to excite mixed feelings. The production was 3,785,810 lb. per day, against 3,776,000 in March. Obviously the curtailment of production by the high-cost producers has not yet offset the increase by such important districts as Ely, Cananea and Cerro de Pasco, which can operate at a profit on the recent level of price. This is an argument against the chances for a striking and permanent advance in price, which would cause production rapidly to increase still farther. On the other hand, it is certainly a source for congratulation that the deliveries for consumption in April gained so materially that the addition to the surplus was only a trifle more than 900,000 pounds.

In commenting upon the statistics for March, we remarked that "It would not be surprising if the production of refined copper should show a decrease in April and if the accumulated stock would begin to wane." Neither forecast was actually realized, but the tendency in both directions was so clearly manifested by the April statistics, combined with the fact that the monthly addition to the surplus has been steadily diminishing since February, that a distinctly favorable impression was created.

STATISTICS FOR MARCH AND APRIL

	March.	April.
Production	117,058,661	113,574,292
Deliveries	108,063,007	112,656,121
Surplus	8,995,654	918,171
Previous	173,284,248	182,279,902
Total	182,279,902	183,198,073

The reception of the April statistics was indeed so favorable that they, together with the influence of some large purchases by manufacturers, led to an advance in the price for the metal. The holders of the accumulated stock are in no uncomfortable position, money being still so cheap. They argue that copper is really worth more than it has been selling for lately and they propose to continue to carry the stock, if necessary. They are able to do so. This situation is well recognized by the manufacturing consumers, who do not expect on the one hand to secure any materially better bargains than have lately been going, and on the other hand do not in any way fear the prospect of having to pay the prices of a runaway market. Any idea of a runaway market under present conditions is, of course, highly absurd and probably does not exist in the mind of any but those whose wish for a boom in the stock market is father to the thought. Apropos of the subject of speculation it may be surmised that a part of the stock reported by the refiners really belongs to speculators who are holding it for an advance to a level much higher than exists at present.

The Missouri Geological Survey

The Missouri Geological Survey is again a storm center. Its career has been tempestuous ever since the days of Arthur Winslow. At present the trouble, as previously, is politics. There seems to be something in the air of Missouri that breeds these political-scientific storms. In view of the vicissitudes that have troubled the State geologist of Missouri, and the ax that is constantly hanging over his head, it is surprising that the organization has been able to do as much good work as it has been able to put on record. Indeed, the Geographical Survey of Missouri has been among the most active of State organizations, and has done some of the most important work in the field of economic geology.

In the present difficulty, charges and countercharges are flying like the volleys of gatling guns. As nearly as we have been able to unravel the tangle, from the newspaper reports, the situation is substantially as follows: The Geological Survey has been planning to absorb the State Bureau of Mines and Mine Inspection. This has naturally been resented by the latter organization, and it, together with

the owners of mineral lands in the central part of the State, have charged that the Geological Survey has been in collusion with the Federal Lead Company (Guggenheims) to prevent the development of the central lead district. In support of this charge, it is stated that E. R. Buckley, formerly State geologist, resigned that position a few months ago to become mining geologist for the Federal Lead Company, and at the same time H. A. Buehler, who had been mining geologist for the Federal Lead Company, was made State geologist at the solicitation of E. S. Gatch, vice president of the board of managers of the Bureau of Geology, who is president of the Granby Mining and Smelting Company (which is alleged to be controlled by the Guggenheims). To clinch matters it is stated that the Geological Survey recently made a report upon the lands of the Granby company. Other mineowners declare that this report "must have been worth millions of dollars to the Granby company," and one gentleman who owns property in the central lead district says that such a report on his mines would be worth several million dollars to him.

Obviously the grievances are (1) the projected absorption of the Bureau of Mines and Mine Inspection; (2) the adverse reports upon the central lead district by the Geological Survey, when in the opinion of owners of property therein the district contains "billions of dollars worth of lead that should be opened up instead of being kept in the background." Why should the Geological Survey have pursued this disdainful policy? Of course, so that the Guggenheims may be able to gobble up the district. Absorption of the Bureau of Mines and Mine Inspection is naturally to enable the Guggenheims to control them both. What a terrible octopus is this Guggenheim organization!

The way in which some honorable names are being bandied about in this Missouri dispute makes it distinctly worth while to throw some light on the matter, which we will do under the following heads:

(1) The only interest of the Guggenheims in Missouri is the Federal Lead Company, and we are disposed to think that it was more or less of a misadventure. The Guggenheims have feet of clay like many other mortals, and in their Missouri enterprise made initial mistakes that would have wrecked about ninety-nine concerns out of a hundred. With their command of great resources, they were able to overcome their setbacks and lay their plans to get out even, perhaps a little more, all of which has been beneficent to the people of Missouri, if we may judge from the extent to which the value of mineral land has been bid up in the southeastern district. We do not believe that the Guggenheims have any stomach to repeat their experience in the central district, but imagine that they would be pleased to see the mineowners of that district develop their property in order to supply the smelting works at Alton.

(2) The Granby Mining and Smelting Company has no more connection with the Guggenheims than the Calumet & Hecla has with the Amalgamated Copper Company. The Granby Mining and Smelting Company is, indeed, a Calumet & Hecla of the zinc business, being one of the historic companies in that industry. It owns an extraordinarily large area of mineral land in southwestern Missouri—far more than is owned by any other company—which is leased to individual miners, or small companies. The Granby property covers a distinct mining district. It was eminently proper that the Geological Survey of the State should make a report upon the Granby district, that report being undoubtedly to the advantage of the people generally. It is also eminently proper that a man holding the high position of Mr. Gatch in the mining and smelting industry should be one of the officers of the board of managers of the Geological Survey. It is, furthermore, proper that Mr. Gatch should be instrumental in naming the State geologist. The people of Missouri should congratulate themselves upon escaping the hand of some broken-down political hack and should prize the services of Mr. Gatch, who honors them by serving. No one in possession of his senses could believe for one minute that Mr. Gatch would ever act in any but the most public-spirited way.

(3) It is true that Mr. Buckley and Mr. Buehler exchanged positions, the place with the Federal Lead Company having been found for Mr. Buehler, while Mr. Buckley, whom he was to succeed, was engaged in finishing his work for the State. The people of Missouri are to be congratulated upon enjoying the services of geologists who are capable of securing important positions in private life.

(4) The central lead district was studied and described with much detail in Winslow's famous report. It has not yet shown any evidence of possessing the importance of either the southeastern or the southwestern districts.

The present dispute illustrates one of the difficulties under which a State official labors as compared with the official of a private company. The latter can dismiss off-hand any mine which the evidence indicates to be not worth the time and expense of an examination. The State official, on the other hand, must fritter away his time and the money of the people in visiting every insignificant prospect, or else be subject to the charge of ignoring "important mineral resources of the State," of course, to serve the purposes of private interests. Politics is the deadly nightshade to science and administration.

We think that the Missouri Geological Survey has made a mistake in planning to absorb the Bureau of Mines and Mine Inspection. The latter has done its work well and the work for which it is organized has nothing to do with the Geological Survey. One organization is to study and promote the development of the mineral resources of the State. The other is to inspect the operating mines and see that there is compliance with the laws of the State. If a State is able to support two such organizations, by all means it ought to do so, and it ought to keep them distinct.

As to the Guggenheims, we think that the people of Missouri have indulged so much in the habit of hunting octopuses that the game has got on their nerves, and they are now apt to mistake a lamb for a monster. The Guggenheims have plenty of troubles of their own. If, however, they show any sign of becoming voracious, we recommend the mineowners of Missouri to follow the plan of those in the Klondike and sell them their properties at as much over the real value as the Guggenheims can be fooled into giving.

The experiments upon smelting zinc ore in the blast furnace which were abandoned at Warren, N. H., two years ago, are to be resumed this spring at Philadelphia, under the direction of F. W. Gordon, who conducted the work at Warren. An entirely new furnace will be built at Philadelphia, on somewhat different lines from that at Warren.

Metallics

We notice this gem of a word in a recent article on organic chemistry:

TETRAMETHYLDIAMINODIPHENYLMETHANE

Platinum ingots as imported in the United States are approximately 5/16 in. thick by 2 to 4 in. wide and weigh about 100 troy ounces each.

According to L. B. Stilwell, the output of the plant of the Niagara Falls Power Company in 1908 was 560,000,000 kw.-hours, equivalent to a saving of more than 1,000,000 tons of coal per annum.

A miner who has been partaking too freely of intoxicants should never be allowed to enter the workings of a mine. He is a menace not only to himself, but to his co-workers. Many instances could be cited of serious accidents caused by the act of some intoxicated miner.

According to J. Bishop & Co., Malvern, Penn., their works was the first establishment for handling platinum in the United States, having been started by Joaquin Bishop in 1842. The process introduced by him for melting and manufacturing platinum for chemical, dental, jewelry and other purposes was subsequently adopted by European manufacturers.

The Dwight & Lloyd sintering machine has been introduced with success at the works of the Ohio & Colorado Smelting Company at Salida, Colo. An installation is now being made at the works of the Federal Lead Company, at Alton, Ill., which will be particularly interesting, inasmuch as a direct comparison can there be made with the Huntington-Heberlein process.

According to John D. Archbold, the Standard Oil Company in 1892 produced from crude petroleum 60,154,790 lb. of crude wax; in 1907 the production was 109,649,553 lb. In 1892 the production of refined wax was 11,271,479 lb.; in 1907 it was 96,564,187 lb. In 1892 the Standard Oil Company produced 2,943,202 lb. of candles; 22,419,073 lb. of candles were produced in 1907.

In keeping his eyes open for carelessness, the mine foreman will do well to pay almost as much attention to the old and experienced miner as to the beginner. The experienced miner often grows careless through long immunity from accidents, taking undue chances and performing some of his duties in a manner that would bring forth from the foreman a well-deserved rebuke if he were a green hand.

According to Edward Brush, in testifying before the Ways and Means Committee, Dec. 16, 1908, the cost of the Garfield smelting works up to that time was in excess of $6,000,000. That figure is higher than what was previously the common belief. However, Mr. Brush probably included the money expended in acquiring the great area of land to forestall smoke troubles, which must have been very large.

According to L. B. Stilwell, about 25,000,000 h.p., steam and hydraulic, are installed for industrial purposes. The aggregate power used by our railways is estimated to be approximately 4,000,000 h.p. The Inland Waterways Commission estimates that the amount of water power available in the United States at cost comparable with steam operations is 37,000,000 h.p., which exceeds our entire mechanical power now in use.

The success of the Warwick Iron and Steel Company with the Gayley process is attracting more attention to it. In 1908 nine licenses for equipping Western blast furnaces were given. The experimental plant at the South Chicago works of the Illinois Steel Company is said to have demonstrated that the process can be successfully applied to bessemer converters, the result being a better and more uniform grade of bessemer steel.

In 1908 the Old Dominion Mining and Smelting Company, of Arizona, changed from the use of Eastern coke in its smeltery to coke obtained from Dawson, N. M. It was found that the furnaces could be run with about as low a percentage of this Western coke as of Eastern coke. The lower cost of the Western coke will effect a saving of between $20,000 and $25,000 per month, or more than 0.5c. per lb. in the cost of producing the copper of the company.

The mineral rutile, which is now mined in Virginia, has found a new use as a component of the electrodes for arc lamps. However, the demand for it is still very irregular. Besides that which was used by the domestic electric companies a considerable exportation was made in 1908. The value of rutile, 97 per cent. pure, varies from $100 to $160 per 2000 lb. For use in the electric industry it must be quite free from most foreign substances. Anything that slags easily is bad for an arc lamp.

It is reported that the Gasmotorenfabrick Deutz, of Germany, is about to introduce an internal-combustion engine to be driven by solid napthalene, which is a cheap by-product obtained in the manufacture of illuminating gas. It is a solid, melting at 79 deg. C. The engines are to be furnished with a special tank in which the naphthalene will be melted by the waste heat from the exhaust and the cylinder water jacket. The air to be carbureted will be heated to avoid solidification of the napthalene.

In sighting at a plumb-bob string in underground surveying a piece of white paper held behind the string and as close to the candle, or other illuminant, as possible, is a great aid to the transitman in making the sight. A permanent and useful arrangement for such work is a cigar box from which the cover has been removed, and a piece of tracing cloth attached to its place. When a lighted candle is put in place in the box and the contrivance held behind the plumb-bob string, the transitman experiences no trouble in finding the sight.

Some of the zinc blende ore of Mexico is high in fluorspar, separation of which by ordinary methods of milling is difficult. The ore of the San Francisco del Oro and Tecolotes mines is of this character. Shipments of concentrates to European smelters have been rejected because of the presence of 5 per cent. of fluorspar. American zinc ores are generally free from that objectionable impurity, but it occurs at Marion, Ky. Some good separations of these ores have been made by fine grinding, very careful sizing, and treatment on pneumatic tables.

When it becomes necessary to enter an old or abandoned shaft, some idea of its general condition may be obtained by the use of an ordinary hand mirror. A sunbeam reflected into the shaft by means of the glass will illuminate the shaft for several hundred feet. If a hand mirror is not available, a highly-polished tape reel, the inner surface of a watch lid, or any other polished reflecting surface, may serve the purpose. Of course, it is necessary that the sun be shining and that the shaft be in the open. By the use of this simple expedient, it is often possible to determine whether or not the shaft is safe.

The customary method of exhibiting mill products is to bottle them. An ingenious and effective system is used by D. V. Keedy. He employs an ordinary album with stiff leaves, such as may serve for mounting photographs. Marking out a rectangle, say, 1x2 in., he coats it with Lepage's liquid glue and sprinkles on the concentrate, midlings, tailings, etc., just as sandpaper is made. Of course, this is limited to the fine sizes, say, 2 mm. and less. A single page may show a series of five or six products in one column, and the assays, remarks, etc., in a parallel column, thus making a highly effective presentation.

An alloy containing 47 to 50 per cent. silicon, 15 to 25 per cent. calcium and 2½ to 6½ per cent. of aluminum is now on the market. It is used for the deoxidation of another metal, silicon, aluminum and calcium being very energetic reducing agents. Added to molten steel in the ladle, it calms the steel and enables the tapping of sound ingots. The product of the reaction is a double silicate of calcium and aluminum, which melts very easily, the slags ascending to the surface of the steel. The new alloy is said to give better results than aluminum, even when it is added into the ingot mold itself, because it forms an easily fusible slag which disengages from the steel.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Tonnage Estimation in Dumps, Open Cuts, etc.

The article by R. J. Donaldson in the JOURNAL of March 27, 1909, on estimating tonnages in dumps, open cuts, etc., has suggested several practical cases that I have met with during my mining experience. Taking up the subject of open-cut measurements first, I am reminded of a system I used at the Bertha zinc mines in Virginia in 1890-91. The ore was originally extracted there by the open-cut method, and a contract had been let for stripping the overburden, paying for the same by the cubic yard.

Those readers who are familiar with the occurrence of the Bertha ores will remember that they lay in pockets and bunches upon the limestone, which had weathered away into an extremely irregular surface formed of deep cavities and high "chimneys." The limestone was overlaid by a deep covering of clay formed from its decomposition.

It was impossible, without consuming much time and labor, to measure the quantity excavated by any system of cross-sectioning, in which the numerous irregularities in the bottoms of the cuts could be taken and recorded. The original surface of the working area was, therefore, divided into 10-ft. squares, and the elevations taken at the intersection points. The elevations at the projection of these points were taken when the estimate measurements were made each month, and the volume determined by planimetering the plotted vertical sections of 10-ft. intervals.

The lines running in one direction were numbered 1, 2, 3, etc., and those at right angles to them were designated A, B, C, AA, BB, CC, etc. Three leveling instruments set at different hights were used, and a long cord having leather tags 10 ft. apart could frequently be stretched parallel to the face of the cut where jutting ridges permitted parallel lines of stakes to be set to fasten the cord. A ring, through which was passed a long line with a plummet attached, was placed on the tagged cord, and the rodman would flip the ring to a tag and determine the point on the ground with the plummet. Frequently all of the instruments would be set too high to take a reading on the rod, in which case the rodman would tie the ring of a tape to one end of the plumbline and pull it up until the cross hair of the instrument would cut the tape ring. The distance to the ground would then be called to the instrument man.

A unique system of note keeping was used, and as I remember it, was as shown in the accompanying sketch:

SYSTEM OF NOTE KEEPING.

Inst. No. 1. Ht. = 112.40			Inst. No. 2. Ht. = 96.30			
A1	A2	A3	A4	A5	A6	A7
10.4	8.6	12.5	3.1	7.6	10.2	12.5
B1	B2		B3	B4	B5	
9.8	12.4		6.2	8.7	10.2	

Inst. No. 3. Ht. = 80.42						
B6	B7	C1	C2	C3	C4	C5
2.1	6.4	0.5	8.3	10.8	12.5	15.2
C6	C7					
20.7	23.1					

The hights of the instruments were determined by turning points from bench marks in the usual way, recorded in another portion of the book, and copied on the page, as shown in the sketch. The remaining notes represent the stations at the intersections of the 10-ft. squares, with the rod readings placed under them.

While engineer for the Ducktown Sulphur, Copper and Iron Company, I was required to estimate a large quantity of ore that had been broken in the West vein of the Mary mine, and lay upon and around a timbered gangway. The ore had been stoped on contract by the ton, and as the mine was being closed down for some time, it was necessary to obtain a close estimate of the tonnage in the piles, in order to settle with the miners. As the surface of the broken ore was very irregular, and it was impossible to get at the sides of it, I was unable to measure it by a direct method. All of the ore from the vein had been stoped on contract by the ton, and a complete record of the tonnage trammed from it was available. I had taken precise cross-sections of the opening at 30-ft. intervals, and was able to compute the volume of the ore stoped from it. To get at the weight of the ore in place, I determined the specific gravity of several representative samples, and took an average of them. I found this to work out to almost exactly 9 cubic feet to the long ton, which was the unit used, the company being an English concern. By deducting the amount mined and shipped from the total quantity stoped, I derived a close estimate of the quantity remaining broken in the mine.

It frequently happens that an engineer for a mining company is called upon to estimate small quantities of broken material that has been left in the mine or on the surface, and is inconvenient for the company to move and weigh. This material has usually been broken or transported by laborers on contract, and it is essential to obtain an accurate estimate of its quantity. It is generally piled in irregular masses where the surface has not been previously determined. I have frequently attempted to make estimates of this kind, and I must say that Mr. Donaldson's statement, "when called upon to measure a dump on irregular ground, with no previous levels on record, a vivid imagination is exceedingly useful," is just as exceedingly true. However, I have sometimes found that the parties who are to be paid for the material have not much respect for my imagination, and where my estimate has been checked by shipping and weighing, I have learned that my imagination was not always sufficiently vivid to afford them what was due. It is extremely unsatisfactory to make an estimate of this kind, and should be avoided if possible.

I estimated the ore reserves of the Tennessee Copper Company, by calculating parallel cross-sectional areas through the orebodies and deriving the cubical contents from averaging them, and multiplying by the perpendicular distance between. The density factor used was 8 cu.ft. per short ton. After obtaining the total tonnage of the developed orebody, I would deduct the amount mined and shipped to obtain "ore in sight." I think this is a more accurate method when the prismoidal formula is used, than that which Mr. Donaldson suggests, of measuring the areas of sections of "proved unstoped ores," especially where the stoped portion cutting two successive sections varies greatly in area, as it certainly does in the Ducktown mines. Of course, the closer together the sections are taken the more accurate will be the results in any method used. Careful records of the ore mined and shipped should always be kept by a mining company.

It might be of interest to state that the weight of the slag produced in smelting the Ducktown ores is just about equaled by that of the ore smelted. I found this to be true by measuring the slag dump of the Tennessee Copper Company, and computing its volume and weight. From the records of ore shipments, the weight of the ore smelted was, approximately, equal

to the calculated slag weight in a total of over 500,000 tons.

B. H. CASE.

Asheville, N. C., May 1, 1909.

Alumina in Copper Blast Furnace Slags

In reference to the discussion concerning the part played by alumina in copper blast-furnace slags, Mr. Beardsley, in his letter to the JOURNAL, Jan. 23, 1909, has ably supported my contention, and from his personal acquaintance with the materials has apparently put the matter beyond question. His affirmation, however, that my statement regarding the lime content of the slag was incorrect is a misinterpretation; I quoted from Heinrich's slags, Nos. 1 to 4, as given in Mr. Shelby's original paper, and did not know of the slags 5 to 9, which, I presume, were given in the 1886 article. These had not been quoted at all previously, and my remark, as applied to the slags quoted, was correct.

In Mr. Shelby's article in the JOURNAL of Dec. 26, 1908, he suggests an error, which I must admit had crept into my letter. I should have stated that the magnetic oxide floated on the "matte" instead of on the "charge." It was to be found both in the slag and the matte, and unlike Mr. Shelby's experience, I found that it was easily separated analytically, owing to its insolubility in acids, being unaffected by fusion with alkalis and its affinity for the magnet.

HARLEY E. HOOPER.

Richmond, Nelson, New Zealand,
March, 16, 1909.

Zinc and Sulphur in Mexico

The zinc production in Mexico has experienced some revival with the removal of all duties on zinc ores into the United States. Anticipating the enactment of the Payne tariff measure, considerable ore has been rushed from northern Mexico into the States. The importance of the zinc deposits in northern Mexico has been greatly exaggerated in the tariff campaign. Most of the carbonate and silicate ore from Nuevo Leon, Coahuila and Chihuahua, has come from old lead-silver workings, from which it was easily obtained. The general result of the operations on deposits of this class of ore has been to prove that they do not extend in depth, and that they will not, in the future, individually or collectively, yield zinc ore extensively. The future great production of zinc in Mexico will come from the treatment, by special processes, of the complex zinkiferous ores, which abound in nearly all of the camps. Heretofore these have been either left in the ground, or sent to the smelters where the zinc passes into the slag and is lost. In the cyanide camps zinc sulphide is not considered as detrimental to the process up to a considerable per cent. and passes into the tailings from which no attempt at recovery has as yet been made. Magnetic and pneumatic separation devices have been installed and operated at Charcas and San Luis Potosi, at Santa Barbara and Calera in Chihuahua, and at Ocotlan, Oaxaca. It is probable that these processes will be more extensively installed in the immediate future, and that flotation and other methods will be used to beneficiate the complex ores, making a marketable zinc product and at the same time improving the grade and quality of the ore for smelting or cyaniding. Some shipments of zinc ore from Taxco, Guerero, have been made to Europe recently *via* Vera Cruz. This ore is high in iron and lead and is not desired by the smelters in the United States. Large quantities of zinc ore exist in the camps of Zaucalpam, Temescaltepec, and Sultepec in the south of the State of Mexico, but they are entirely unavailable at the present time, owing to lack of railroad connection. Recently some promising zinc operations have been undertaken in Jalisco, Sinaloa and Sonora, in the districts tributary to the Pacific coast ports. This ore is mainly sulphide, and will be shipped by boat to Europe or *via* the Tehuantepec Isthmus line. Many of the Mexican zinc-sulphide ores carry silver, and the smelters in Europe pay about half the market price for the silver content over 5 oz. There is no export duty on zinc ores from Mexico, and the silver in these ores under 250 gm. is exempt from export tax.

Sulphur is being shipped from Mexico to Europe from the Los Cerritos deposits between Tampico and San Luis Potosi. All the product is in demand at good prices. The sulphur deposits at Conejos, near Torreon, are being worked intermittently to supply the dynamite factory, at Gomez Palacio, and for local demand. Other important sulphur deposits exist in Tamaulipas and in lower California, but they are not being worked, owing to their distance from the railroad. The much vaunted Popocatapetl deposit in the volcano, near Mexico City, is a myth. It is true that the Spaniards obtained sulphur from the crater for the manufacture of gunpowder, and at other times small supplies have been obtained for local uses. A few years ago the deposit was exploited in the interests of certain New York capitalists, and it was reported that there were millions of tons to be obtained. The fact is the supply is very limited, being merely incrustations of native sulphur on the rocks in the bottom of the crater in which there are a few vents which give forth continually vapors and fumes. The volcano is 18,000 ft. high, snow capped, and difficult of ascent, and the vents are at the bottom of a crater 2000 ft. deep, with steep walls, so that, considering the limited supply, and the difficulties of operation, Popocatapetl can be eliminated as a possible source of a sulphur supply now and hereafter. An interesting sulphur supply is found at Sierra Mojado, Coahuila, in one of the mines belonging to the American Smelting and Refining Company. Native sulphur forms the matrix of an ore containing iron and lead carbonates with silver. An effort was made to extract the sulphur by the use of superheated steam, but owing to the physical character of the ore, the resulting product in the retorts formed a slimy mass which retained the liquified sulphur by capillary action and prevented a successful extraction. A modification of the method of treatment is being investigated and if successful this deposit may become a considerable producer of sulphur as a by-product. At none of the smelters in Mexico is the sulphur from the fumes saved.

Separating Metals in Solution

Herbert H. Dow, of Midland, Mich., and Walter S. Gates, of Worthington, Can., describe in U. S. Pat. 913,708 and 913,709, March 2, 1909, a process of separating metals, particularly iron, copper and nickel, from the same water solution as precipitates, each substantially free from the others. The basic principle is, the purification of any precipitated metal by agitating the precipitate in a solution containing soluble salts of the more insoluble metal. The water solution of iron, copper and nickel is agitated in any suitable vessel with powdered limestone in an amount equal to the chemical equivalent of the iron in the solution. This results in the precipitation of most of the iron as a hydrate and by a prolonged agitation of the precipitates in the original solution, the iron precipitate is purified. The excess of iron salt slowly dissolves the copper and nickel basic carbonates contained in the insoluble ferric hydrate, and precipitates in turn more ferric hydrate. After a prolonged agitation with a proper reagent the ferric hydrate is found to be substantially free of the copper and nickel basic carbonates, and the solution free of iron. Similar steps are taken for the precipitation of copper and nickel. This principle can also be applied to the separation of aluminum from nickel and copper, as well as iron in both conditions of oxidation.

All of the leading mining companies in the silver-lead district of Western Tasmania, according to Consul Henry D. Baker, showed a diminution in their earnings during 1908, with the exception of several companies engaged in mining coal; this was the only mineral product whose value showed an increase over that of 1907.

New Publications

THE MINING MANUAL FOR 1909. By Walr. Skinner. Pp. 1425. 5½x8½ in.; cloth, 21s. London, 1909: Walter R. Skinner.

HANDBOOK OF SOUTH AUSTRALIA. By David J. Gordon. Pp. 344, illustrated. 7x9½ in.; board covers. Adelaide, 1908: C. E. Bristow, Government Printer.

THE CHEMISTRY AND LITERATURE OF BERYLLIUM. By Charles Lathrop Parsons. Pp. 180. 6x9 in.; cloth, $2. Easton, Penn., 1909: The Chemical Publishing Company.

REPORT OF THE DEPARTMENT OF MINES, PROVINCE OF NOVA SCOTIA, 1908. Pp. 169, illustrated. 6½x9½ in.; paper. Halifax, N. S., 1909: Commissioner Public Works and Mines.

PEAT DEPOSITS OF MAINE. By Edson S. Bastin and Charles A. Davis. U. S. Geological Survey, Bull. No. 376. Pp. 127, illustrated. 6x9 in.; paper. Washington, 1909: Government Printing Office.

FISIONOMIA MINERA DE LAS PROVINCIAS DE TAYACAJA, ANGARAES Y HUANCAVELICA. By Enrique I. Dueñas. Boletin del Cuerpo de Ingenieros de Minas del Perú, No. 62. Pp. 197; illustrated. 6¼x9½ in.; paper. Lima, Peru, 1908: Ministerio de Fomento.

BIBLIOGRAPHY OF NORTH AMERICAN GEOLOGY FOR 1906 AND 1907, WITH SUBJECT INDEX. By F. B. Weeks and J. M. Nickles. U. S. Geological survey. Bulletin No. 372. Pp. 317. 6x9 in.; paper. Washington, 1909: Government Printing Office.

THE SIGNIFICANCE OF DRAFTS IN STEAM-BOILER PRACTICE. By Walter T. Ray and Henry Kreisinger. U. S. Geological Survey, Bull. No. 367. Pp. 60, illustrated. 6x9 in.; paper. Washington, 1909: Government Printing Office.

THE MINING YEAR-BOOK, 1909, WITH DIRECTORIES OF DIRECTORS, SECRETARIES, MINING ENGINEERS AND METALLURGISTS; GLOSSARY OF MINING TERMS. Edited by A. N. Jackman. Pp. 1230. 5½x8½ in.; cloth, 15s. London, 1909: The Financial Times.

WESTERN AUSTRALIA GEOLOGICAL SURVEY. Bulletin No. 31. Part I—The Bonnievale and Kunanalling Districts, Coolgardie, Goldfield. Part II—The Black Range District, East Murchison Goldfield. By Charles G. Gibson. Pp. 120; illustrated. 5½x8½ in.; paper. Perth, 1908: Western Australia Geological Survey.

LES ACCIDENTS DUS A L'EMPLOI DES EXPLOSIFS DANS LES MINES ET CARRIERES SOUTERRAINES DE BELGIQUE PENDANT LES 15 DERNIERES ANNEES 1893 A 1907 INCLUS. *Extrait des Annales des Mines de Belgique, tome XIV.* By Victor Watteyne and Adolphe Breyre. Pp. 268, illustrated. 6¼x9½ in.; paper. Bruxelles, 1909: Ministère de L'Industrie Et Du Travail.

ELEMENTS OF OPTICAL MINERALOGY. An Introduction to Microscopic Petrography. By N. H. Winchell and Alexander N. Winchell. Pp. 502; illustrated. 6x9½ in.; cloth, $3.50. New York, 1909: D. Van Nostrand Company.

Contents: Certain phenomena of light. Elements of mineralogy. Application of polarized light to crystalline substances. Description of minerals. Analytical tables. Appendix.

TEXT BOOK OF PETROLOGY. By F. H. Hatch. Fifth edition, revised and rewritten. Pp. 404; illustrated. 5x7 in.; cloth, 90c. London, 1909, Swan Sonnenschein & Co.; New York, The Macmillan Company.

This well known treatise is a summary of the modern theories of rock genesis, and includes a description of the rock forming minerals and the chief types of the igneous rocks. It is one of the most satisfactory works upon the subject of petrology and students will be glad to have it in this thoroughly revised form.

MINING METHODS IN EUROPE. By Lucius W. Mayer. Pp. 169, illustrated. 6¼x9¼ in.; cloth, $2.50. New York and London, 1909: Hill Publishing Company.

Contents: Mining in Great Britain. Mining in Germany, France and other countries.

This book does not pretend to be a broad treatise on the subject implied by its title, but rather is the journal of a visit for technical study among some important mines in Europe. Several of the chapters composing the book have previously been published as papers in the JOURNAL and elsewhere. They describe some interesting and unique mining methods and are well worth perusal.

ASPHALTS: THEIR SOURCES AND UTILIZATIONS. By T. Hugh Boorman. Pp. 172; illustrated. 7x10 in.; cloth, $3. New York, 1908: William T. Comstock.

Contents: Discovery and early use of asphalt. Rock asphalt mastic or asphalt coulé. Trinidad asphalt. Petroleum residuum and California malthas as a fluxing material. Venezuela asphalts. Cuban asphalts. American bituminous limestone. Bituminous asphalt sandstone rock. Manjak and uintaite. Late European work. Turkish and other bitumens. Developments of asphalt industry up to 1903. Asphalts in 1908. Asphalt in building construction. Dustless roads. Methods of surfacing roads. Asphaltic oils, their classification and properties. Application of asphaltic oils. Sprinkling with asphaltic oils. Latest views of engineers on asphaltic surfacing. Municipal asphalt plants. Asphalt waterproofing. Asphalt in roofing. Asphalt for manufacture. Asphalt machinery.

This is an interesting and valuable treatise upon an important subject in which the author is a well known expert.

THE WORLD'S GOLD. By L. de Launay. Translated by O. C. Williams, with an introduction by Charles A. Conant. Pp. 242; 5½x8 inches; cloth, $1.75. New York, 1908: G. P. Putnam's Sons.

The sub-title of this important work is "Its Geology, Extraction and Political Economy." The last is the main subject, the geological occurrence of the metal and the methods for its extraction being discussed as leading up to it. The geological treatise is of much interest and value, as naturally to be expected from this distinguished author. The treatment of the methods of mining and metallurgical extraction are far less satisfactory. The economic section is of absorbing interest. This deals chiefly, of course, with the great question of the day, viz., "Has the value of gold depreciated?," or "Is the rise of commodity prices due to the increasing production of gold?" While fully recognizing the effect of gold supply upon commodity prices, Professor de Launay holds, like many other economists, that that effect, one way or the other, is generally offset by other factors, and in general he denies the depreciation theory that has lately found much acceptance. In this we fully agree with Professor de Launay.

MILLWRIGHTING. By James F. Hobart. Pp. 401, illustrated. 6¼x9½ in.; cloth, $3. New York and London, 1909: Hill Publishing Company.

Contents: The millwright and what he is. Factory location. Laying out the buildings. The builder's level and foundations. Foundations and the carpenter's level. Erecting building and machinery foundations. Erection of buildings. Walls and machinery supports. Roof timbering and trusses. Strength of materials. Laying out shafting. Putting pulleys in place. Belts and belting. Setting up machines. Babbitting, scraping and lubricating. Steam and water pipe fitting. Erecting steam engines. Steam boiler setting. Some shop work. Water wheel setting.

The scope of this book is indicated by the table of contents reproduced above, but even the latter fails to give a thorough idea of the great variety of subjects treated by the author and the minuteness of his details. As a matter of fact he takes up every kind of work that the millwright erecting a building, a mill or factory, and setting machinery is required to do and his advice is uniformly sound. A distinguishing feature is its eminently practical character. It is an uncommonly good book and will be highly useful to engineers, including the mining, metallurgical and chemical, as well as to millwrights and erectors.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

R. Gilman Brown has been in West Africa, and will soon return to London.

Edward L. Dufourcq has left New York on a professional trip to Colorado and Mexico.

Washington B. Vanderlip has opened an office as consulting mining engineer at 42 Broadway, New York.

George D. Reid, who has been examining copper properties in Idaho and Oregon, has returned to Denver.

A. M. Yonge has been appointed general superintendent of the Aguacate mines, San Mateo, Costa Rica.

Quincy A. Shaw, vice-president of the Calumet & Hecla, is in the Lake country, on one of his semi-annual visits to the property.

Dr. W. F. King, chief astronomer of Canada, has been appointed superintendent of the Geodetic Survey of Canada, just established.

J. W. Astley, of Victoria, B. C., is in Ontario, making a trip in the Cobalt and Gowganda districts, with a view to following his profession there.

Emmet D. Boyle is completing the erection of the Nevada Gypsum Company's new plant at Mound House, Nev., and will remain at that place until June.

W. S. Keith has been appointed assistant manager for C. Christopher and associates, of Seattle, Wash., who have bought the rights of the Cotton matting furnace for several of the northwestern States.

George E. Farish, of Denver, Colo., and Mexico City, left Denver on May 3 to examine some properties in southern Mexico. His address for the next three months will be 2 Bucareli, No. 35, Mexico City, Mexico.

A. R. Wilson has resigned as superintendent for the Maple Leaf Coal Company, Frank, Alberta, having been appointed a coal-mine inspector by the government of Alberta for the district east of Lundbreck.

C. H. MacMillan, formerly superintendent of the Dominion Iron and Steel Company, at Sydney, N. S., who has been resting in Maine for a year or so, has been appointed superintendent of the steel department of the company.

Prof. Charles Baskerville, director of the Chemical Laboratory, College of the City of New York, will sail for London on May 15 on the steamer "Kroonland," to attend the Seventh International Congress of Applied Chemistry. He will be abroad all summer.

Ernest V. Moore, Herbert Garnett and Francis J. Bulask have associated themselves under the name of the Peat Engineering Company and established an office in Toledo, Ohio, where they will act as consulting engineers on all questions relating to the utilization of peat and peat bogs.

Norman W. Haire has resigned as general manager of the properties that comprised the Bigelow group in the Lake Superior copper district and is succeeded by James MacNaughton, general manager of the Calumet & Hecla. Mr. Haire will make his permanent home at Houghton, Mich.

R. M. Atwater, Jr., Robert Linton and R. de Sallier have been examining the Dominion Copper Company's mining properties, in the Boundary district of British Columbia, for the protective committee of dissenting stock and bondholders, who are opposed to the reorganization scheme of the majority.

A. S. Dwight has not taken charge of the Humboldt works as general manager for the Consolidated Arizona Smelting Company, as has been erroneously stated in the press. He is at Humboldt as consulting engineer, to try to develop a rational and safe program for resumption of operations, and is being assisted by Francis N. Flynn, mining engineer, of Globe, Ariz. Mr. Dwight will go from Humboldt to Douglas and expects to be back in New York early in June.

Obituary

J. Fewson Smith, a pioneer among Utah engineers, died at Salt Lake City, May 5. He was born at Preston, England in 1834 and educated as a civil engineer. He went to Utah in 1863, and there engaged in active work. He was employed in the construction of the Union Pacific and the Utah Central railroads and the Oregon Short Line. Later he located and supervised the construction of several narrow-gage roads intended to open the mining districts of Utah—among them the American Fork, the Bingham Cañon and the Pleasant Valley railroads. At different times he conducted extensive explorations in southern Utah and Nevada, and he always predicted an important future for the mineral interests of those districts. He was not a civil engineer only, but had done much mining work. For many years he held a commission as deputy mineral surveyor, and many of the more important mining camps in Utah are built up around the claims he originally located. This is especially true of Bingham, where he did so much of the early work. He also made many of the earlier government-land surveys in various parts of Utah; did some municipal work, and has frequently been called into consultation in matters of hydraulic installations, both in Utah and other western States. In this way he was connected with the early placer mining in southern Nevada. Between 1891 and 1899 he spent much time in Mexico, where he was engaged in engineering and exploration work in Chihuahua and Sonora. He served some years as chairman of the water commission of Salt Lake City. Some of his later work was done for the United States Smelting, Refining and Mining Company, for which his son, J. Fewson Smith, Jr., is mining engineer. A few years ago Mr. Smith retired from active work on account of advancing age.

Societies and Technical Schools

Coal Mining Institute of America—The summer meeting will be held at Punxsutawney, Penn., during the last week in June.

Coal Mining Inspectors' Institute of America—This society will hold its summer meeting at Scranton, Penn., beginning June 8 next.

Institution of Mining and Metallurgy—The annual dinner of the institution was held in London last week under the chairmanship of Edgar Taylor, the president for the present year. There was a large gathering of members and guests. The important work that the institution is doing in promoting and in maintaining a high standard for professional conduct, was referred to by the speakers.

West Virginia Coal Mining Institute—The next meeting will be held at Elkins, W. Va., June 1 and 2. The meeting, in considerable part, will be devoted to the discussion of accidents and their prevention. Addresses or papers are expected from J. A. Holmes, Frank Haas, W. A. MacCorkle, Clarence Hall, F. C. Albrecht, D. T. Evans and A. G. Morse.

Canadian Mining Institute—The fifth general meeting of the Western Branch of the Canadian Mining Institute will be held at Coleman, Alberta, on May 25, when several papers by members on mining and metallurgical subjects will be read and discussed. The branch numbers about 200 members, including all members of the institute resident in western Canada and adjacent parts of the United States. Thomas Kiddie, manager of the Le Roi Mining Company's smelter at Northport, Wash., is this year's chairman, and E. Jacobs, Victoria, B. C., secretary.

California Mineowners—At a large meeting of mineowners, held recently in San Francisco, the result of the discussion and deliberation was formulated in a resolution to the effect that a fair interpretation of the term "period of employment for all persons engaged in work in underground mines" should mean work "at the face" and not include the time taken by miners and other employees in going to and from the face, or the time taken for meals.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Indianapolis, Goldfield, Salt Lake City, Mexico

REVIEWS OF IMPORTANT EVENTS

San Francisco

May 8—The El Dorado-Placer Dredging Company has been organized at Auburn, Placer county, to mine by dredges the auriferous bed of the American river, which stream forms the boundaries of Placer and El Dorado counties. Los Angeles, San Bernardino and Tucson men are interested, among them E. K. Hum, W. J. Variel, M. E. Williams, D. H. Gillan, B. F. Bledsoe and Thomas F. Wilson. The company has been organized under the laws of Arizona. The Northern California Mining Company, which recently started a new suction dredge on the Klamath river near Hamburg, owns many miles of the bed of the Klamath river. There are many large rocks and bowlders to be encountered and predictions of failure of enterprises have been made by old-time miners. It is already found that wood fuel is too expensive and arrangements are being made to use fuel oil. The first gold dredge in the Butte Creek section of Butte county was put in operation last week after several preliminary tests. Work has been commenced six miles southeast of Chico. Los Angeles men are the principal owners in this new enterprise.

The Appellate Court has handed down a decision adverse to the appeal of the Grand Pacific Gold Mining Company involving the Bully Boy placer claim in Calaveras county. The decision is to the effect that the San Domingo Gold Mining Company is awarded the mine on the ground that its title was properly obtained.

On application of R. G. Hart, the Superior Court at Yreka, Siskiyou county, has issued an injunction against Mitchell & Fairchild ordering them from making any excavations or doing any work on the Inyo or Digger Squirrel claim in Humbug district, a few miles from Yreka. Hart claims that he is the original locator and that the others have located over the same ground.

The Idaho-Maryland mine at Grass Valley, which has had 20 stamps at work for some time will soon have the other 20 of the mill at work, there being now ore enough coming out to keep them all busy. The ledge being now worked is quite wide and runs over $10 per ton.

After a year or more of experimenting, those in charge of the electric iron-ore smelter at Heroult, Shasta county, consider that they have made a commercial success of the project. The large new furnace was tapped for the first time last week. It is expected that the furnace will turn out about 200 tons of commercial pig iron daily.

Butte

May 5—In the case of the South Butte Mining Company against the East Butte Mining Company, the motion of defendant for a new trial was recently denied, and an appeal will be taken to the supreme court of the State. The court some time ago decided that the South Butte Company was entitled to the ground over which the dispute arose and also awarded the South Butte Company judgment for $19,531 as damages for the taking of ore from the disputed ground. It is reported that the Northern Pacific railway is planning to build from Mandan to Glendive. The route was surveyed two years ago.

The Montana State Railway Commission held a hearing last week at which the advisability of establishing joint freight rates between the Northern Pacific and the Billings & Northern railways was considered. The commission has taken the matter under advisement.

In the case of the South Butte Mining Company against Frank H. Cooney, the Federal district court has recently entered a decree in favor of the mining company quieting its title to numerous mining claims near the tracks of the Great Northern railway in the southern part of Butte.

Denver

May 7—A celebration of the fiftieth anniversary of the discovery of gold in Colorado by George Jackson in January, 1859, was held at Idaho Springs today, when a monument was unveiled and dedicated. It was erected on Jackson Bar, Clear creek, where the first gold dust and nuggets were found. Many pioneers, now leading men of the State, attended the ceremonies.

There is considerable loose talk just now in the local mining and quasi-mining papers of this State about the discovery of radium ore, meaning the pitchblende (uraninite) of the Wood and other mines in Gilpin county. In this connection it is important to remember that Dr. Richard Pearce was the first to note the existence of, and to identify, pitchblende, the commercial source of radium in that district. He not only identified the ore, but purchased all in sight and sent it to Europe, realizing a neat sum on the transaction.

The agitation here by the tungsten producers and the commercial association, it now appears, will result in a delegation being sent to Washington, to endeavor to secure enough votes to carry the amendment of Senator Guggenheim providing for a 20 per cent. ad valorem duty on the ore.

At Leadville, the Yak tunnel is said to be advancing at the rate of 10 ft. per day and will reach and drain the Dolly B. mine during the summer. The tunnel has already drained the Resurrection No. 1 shaft to within 35 ft. of the bottom. The Leadville district mill has been reopened, and is treating the sulphide ores from the Ibex lease. Work has also been started again on the Colonel Sellars zinc dump, and the product is being sent to the Empire Zinc Company's plant at Canon City.

It is reported today that the Golden Cycle Mining Company has purchased the property of the Pikes Peak Coal Company, in addition to the 1500 acres which it already owns in the coalfield four miles north of Colorado Springs, and will build a power plant at the Pikeview mine to supply power to its mill in the valley and its mine on Bull hill. It is stated that the initial cost will be $200,000, and it will start with a capacity of 1200 kilowatts.

Work was commenced on the aërial tram from the Midget mine, on Gold hill, to the Gold Issue mill, on Carbonate hill, a distance of two miles. This is following the lead of the Cresson company, on Raven hill, whose tramway paid for its construction in less than one year. It is said that many other mines more or less remote from the railway will adopt this plan of delivering their ores direct into the cars.

At Crisman, near Boulder, the better price and outlook for silver has resulted in the installation of machinery for the reopening and working on a large scale of the Yellow Pine mine, which is credited with the production of about half a million dollars in silver.

The mining exchange of Colorado Springs has declined to contribute $5000 toward the completion of the Cripple Creek deep-drainage tunnel, on the ground that the brokers were large stockholders of companies which had already contributed.

At Idaho Springs the Albro mine, which is credited with a production of gold and copper to the value of $600,000, is to be developed at a depth of about 700 ft. below the surface by a tunnel 1500

ft. in length, and which is already in 700 ft. Work was resumed on the tunnel this week. In the same camp a strike is reported in the Lucania tunnel of lead and copper ore. This tunnel is already advanced over 4000 ft. from the portal, and 2000 ft. more will put the heading under the upper end of Russell gulch, and drain the mines of that section. At Georgetown a strike is reported in the Sunburst mine on Democrat mountain, 2 ft. of high-grade silver-lead ore having been encountered.

At the silver camp of Aspen, the improvement in the price of that metal has already caused greater activity, and in the Della S., leased by the Smuggler company, a large orebody is stated to have been opened on the ninth and tenth levels. A joint pumping arrangement has been entered into by the Aspen, Durant, Argentum-Juniata, Mollie Gibson, Park Regent, Mineral Farm and Smuggler, the managers of which are to unite in installing a big pump on the Free Silver shaft. The Smuggler, which has hitherto pumped for these properties, is also increasing its working force.

At the mines around Ashcroft the same activity prevails, and on the big silver-lead Tam O'Shanter mine a ten-year lease, with option of purchase, has been granted to responsible men, and operations will begin as soon as the snow at that elevation (12,000 ft.) will permit. The asbestos deposits on Casper mountain, Wyo., are to be developed this summer for immediate production by the North American Asbestos Company.

Indianapolis

May 11—One important mining case to be tried in the Circuit Court this term is that of Benjamin Simpson against the Big Four Railroad Company for damages in the sum of $200,000. The suit grows out of the flooding of the plaintiff's mines, in Clay county, through the alleged negligence of the railroad company.

The suit is important because it is the first of the kind in the State and mine owners are interested in the result.

Simpson owns and operates a system of mines in Clay county through which the St. Louis division of the Big Four runs. When the improvements were made in the tracks of the company, the grade was lowered to a considerable depth through plantiff's coal lands, and in blasting an opening was made into a tunnel which Simpson had constructed under the track. Soon after this heavy rains came and the mines were flooded. The railroad company defends on the ground that Simpson had no right to make these tunnels without its consent or knowledge, and that the State law provides that all mineowners shall file a complete plan of their mines in the county recorder's office in the county in which they operate, and also with the State mine inspector, neither of which Simpson has done, it is alleged.

The announcement of the Indiana Steel Company that the construction of coke ovens for the local plant at Gary will begin immediately is received with favor by Indiana coal operators. The first lot of ovens to be built will number 560 and will use nearly 7000 tons of coal a day. The ovens are expected to furnish coke for the operation of ten blast furnaces. The site of the ovens is on the Gary harbor, just east of the blast furnaces now in operation, and will cover 300 acres of land. The gas from the coke ovens will be used for fuel in the mills and throughout the city and vicinity.

Two new coal-mining companies were incorporated during the past week. The Optimo Mining Company, with home office in Indianapolis and the Alliance Coal Company, also of Indianapolis.

In the case of Frank B. Mahan *vs.* The Hymera Coal Mining Company the Indiana Appellate Court holds that when a coal-mining company permitted the "wall" between two entries to be reduced in thickness to 5 ft., and then permitted a shot to be drilled and placed in this thin partition so as to blow out the wall from the other side and injure a workman employed in the adjoining entry, who had no knowledge of how thin such wall was, the depth at which the shot was placed, nor that it was about to be fired, the company is liable in damages. The court further held that the negligence of a fellow servant in placing and firing the shot concurred with its own negligence to cause the injury, is no defense to an action based on a complaint alleging that the injury was due to insufficient and unsafe thickness of the pillars left standing between the entries.

Salt Lake City

May 7—The business of the Government assay office at Salt Lake City showed a marked increase for April. The total value of the bullion handled during April was $119,420. The number of ounces was 13,080, the value of the silver in the bullion being $2957. The large customers of the Salt Lake office are the Consolidated Mercur Gold Mines Company with an output of $60,000 to $70,000 per month and the Bamberger Delamar Company whose bullion product amounts to about $40,000 per month. The remainder of the receipts is made up from various sources.

The permanent organization of the Utah Stock and Mining Exchange is being completed. The election of four additional directors is to take place on May 8. The work of fitting up the call room for the exchange has been delayed. It is expected that the exchange will start transacting business about May 15.

Tintic ore shipments during the past week were as follows: Centennial Eureka, 45; Eagle and Blue Bell (leasers), 1; Eureka Hill (leasers), 3; Bullion Beck (leasers) 2; Utah Consolidated (leasers), 1; Sioux Consolidated, 14; May Day, 5; Mammoth, 6; Beck Tunnel, 3; Black Jack, 13; Brooklyn, 5; Iron Blossom, 41; Dragon Iron, 35; Colorado, 23; Yankee Consolidated, 4; total, 205 cars.

The International Smelting and Refining Company has completed six of the seven miles of railroad track that is being constructed to connect the new smelter site of the company with the San Pedro, Los Angeles & Salt Lake railway's main line. A 500-ft. steel trestle has also been finished.

The month of April was the greatest month in the history of Bingham in the mining and transportation of ore, 6128 cars of ore being shipped. The greater part of this tonnage was shipped by the Utah Copper and Boston Consolidated companies. Of a total of 337,040 tons produced by the camp, the Utah Copper Company shipped 264,550 tons; the Boston Consolidated, 58,905 tons; the Utah Apex and Bingham-New Haven, with a few other companies, contributed the balance of the ore shipped.

The annual meeting of the shareholders of the Silver King Coalition Mines Company will be held on May 17. Up to date the Silver King mines have returned to the shareholders earnings in excess of $12,000,000.

The silver-lead smelting plant of the American Smelting & Refining Company at Murray, is out of blast by reason of a walkout of the foreign laborers who wanted a 25-cent increase, a restoration of the schedule of wages in force before the panic. While the mechanics and other Americans employed were not directly connected with the movement of the Greeks and Austrians, nevertheless they decided to stay away until the matter has been adjusted. The Murray plant has eight blast furnaces, but only five were in blast at the time of the walkout. These have been banked. Notices have been posted at the works stating that all foreigners employed at the smelter were discharged and would not be employed at the plant again. It is understood that the employment of American labor only is being considered.

Goldfield, Nevada

May 6—The available figures show that the production of Goldfield for April was somewhat below that for March. This is due to two causes: namely, the output of the Consolidated was cut down by prospecting the walls of the Hampton stope, with the result that much low-grade material was broken. There was also a curtailment in the production from other portions of the property. Two accidents to machinery at the Florence mill handicapped the output of this plant.

The shipments from the Nevada Consolidated and Cumberland-Ely mines in April were heavier than for any month since the first unit of the mill was put in operation last July. A new record was made for a day's output—6,500 tons of ore. It is expected that the fourth unit of the concentrator will go into commission about July 15, and the plant will then be able to handle between 8000 and 9000 tons of ore daily.

There is considerable interest manifested in the control of the Mayflower-Bullfrog Consolidated Mining Company. A. C. Eisen, president of the company, has issued a call for a special meeting of the stockholders of the company to be held at the home office in Rhyolite, May 15. This action by Mr. Eisen is taken as an effort to secure control by ousting the present directors and electing a new board of his own naming.

The estimated production of Goldfield during the first week of May was: Goldfield Consolidated, $256,000; Florence, $25,000; Combination Fraction, $20,000; Daisy, $6000; and miscellaneous mines and leases, $10,000, making a total for the week of $317,000.

Mexico

May 5—The new mining law will probably not come up at the present session of the Mexican congress. During the recess many points in connection with the law were raised by interested parties, relating more particularly to other sections than those which were given prominence in early objections to the new law—the so-called anti-foreign clauses. Inasmuch as the law is intended to be a codification of all the existing laws and decrees, it is exceedingly broad in its scope, and touches on many points that are naturally open for discussion. It is said that the delay in enacting the law is due to the necessity of much consideration of these new points and phases. The law really includes the substance of the famous "Ordinance of Mining" enacted in 1784, for the Colony of New Spain, and continued in force practically 100 years with some important modifications in 1892. These ordinances have been pronounced by legal students as the most complete and perfect mining laws ever enacted. In the form of the enactment of the new law by Congress the old laws, based chiefly on the modifications of 1892, continued in force, and these, in the main, are very good and satisfactory to all the mining interests of Mexico, foreign and local.

Considerable capital is being invested in Mexico in mining and industrial enterprises. A deal in Santa Eulalia, Chihuahua, has just been made and last week the engineering firm of Denny Brothers, of London and South Africa, closed a negotiation for the San Martin mine at Ocotlan, Oaxaca, paying in the neighborhood of half a million pesos for it. The mine was developed by Frank Leonard, of Butte, Mont., who represented the interests of F. Augustus Heinze. Much of the stock was held in Mexico City. Other Canadian and English companies have secured the Greene road in Chihuahua and are planning large hydro-electric plants for northern Mexico.

London

Whether the number of accidents in mines could be lessened by employing a larger number of inspectors was the subject of a debate in Parliament during the week. The supporter of the motion urged that the official statistics understated the number of accidents that occurred and that it was only the more serious ones that were recorded. No complaint was urged against the efficiency of the mine inspectors; the demand was that their numbers should be increased so that there might be less chance of the statutory regulations being broken. The Government was also urged to assist financially in the establishment of rescue brigades with proper equipment ready to give prompt assistance in the case of an explosion. The spokesman of the Home Department, which is responsible for the proper carrying out of the Mines Regulation acts pointed out that it would be unwise to lessen the responsibility of the mine officials. Under the present system inspectors visited mines on three occasions. They made an inquiry after an accident to see if that accident had been caused by neglect and to find out who was to blame. They also visited a mine when any complaint reached them showing a *prima facie* case for inquiry, and they also made occasional visits to see that the regulations laid down by law were being observed. It was, however, recognized that, owing to the increase of mining operations and to the extended use of electricity, many new duties were thrown upon the inspectors and that, therefore, an additional staff was, perhaps, required. It was not proposed, however, to make any changes until the Royal Commission on Mines, now sitting, had presented a report, which was expected within the next few months. It was further a difficult matter to decide what class of new inspector was required, whether there should be additional men of the standing and attainments of the present inspectors, or whether another class of less highly trained men should be employed as sub-inspectors. Many of the accidents that occurred in mines are due to carelessnes of the miners, which no amount of inspection can prevent. Rules are made, but are constantly broken. Many statistics were given showing the reduction in the death and accident rate that had been made, compared with former years. One speaker said that within the last 36 years the death rate from accidents in mines had been reduced by 40 per cent., notwithstanding the greater depth and extent of the mines.

The deaths from accidents were now 1300 a year, but if they had gone on at the same rate as 40 years ago they would be over 3000 a year. The regulations and the greater scientific knowledge saved, therefore, some 2000 lives a year to the country.

In Great Britain the accident death rate was more favorable than in many foreign countries. In 1906 the death rate in France was 1.29 per 1000 employed; in Germany, 1.88, or 50 per cent. higher than in this country; in the United States 3.2 per thousand, or 150 per cent. higher. In Great Britain there has been a general decline in the death rate. In 1901 the proportion was 1.34 per thousand; in 1902, 1.23; in 1903, 1.25; in 1904, 1.24; in 1905, 1.35; in 1906, 1.29; in 1907, 1.31, and in 1908, 1.32 per cent. While these figures were encouraging, it did not mean that the actual irreducible minimum had been reached. Germany and the United States had worse statistics, but Belgium and France slightly better statistics than England.

The report of the South Crofty mine in Cornwall, which has recently been re-equipped, gives particulars of the work that has been carried on during the past year. The average grade of the ore won was 32 lb. per long ton of tin and wolfram mixed. The ore also contains a recoverable value of 2s. 6d. in arsenic, which is now refined on the mine and not sold, as formerly, as soot. The mill was one of 60 stamps and the operating expenses have been reduced to under 20s. per ton. These costs include all mine-working costs, but are exclusive of London charges and depreciation. The production has reached 28 tons black tin in the fortnight and it is hoped shortly to increase that production to 30 tons.

During the past year wolfram averaged £89 11s. 9d. and the black tin, £77 5s. 9d. The arsenic averaged £8 1s. 10d. The company is now making profits and better results are expected by the management in the future, as the mine gets opened out in depth.

In spite of the fact that particular attention is paid to the ore-dressing department, some tin appears to be getting away as an offer has been made by a tin streamer to erect a slimes-saving plant below the company's mill. This offer the company has accepted, the manager considering that the work of the streamer would be a useful check on the extraction of his own plant. The tin streamer has to pay dues on his catch and to allow the company to compete with him if they find additional plant pays.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

JEFFERSON COUNTY

Tennessee Coal, Iron and Railroad Company—The rail mill at Ensley has been closed down, and the date of its restarting is uncertain. Alice furnace in Birmingham is undergoing extensive repairs, and some of the coke ovens are being rebuilt; as soon as the furnace is finished it is expected that it will be put in blast. No. 1 furnace at Ensley is also being repaired. Most of the coke which would otherwise be used at the steel plant and furnaces at Ensley will be stocked instead of closing down the ovens.

Alaska

PRINCE OF WALES ISLAND

The Mt. Andrew mine is making a shipment of 2400 tons of copper ore to the Tacoma smelter. The working force at the mine has been increased to 40 men. This shipment will stimulate other important mining operations in southeastern Alaska.

Arizona

COCHISE COUNTY

Copper Queen—All the ore from the Queen properties, except the Lowell, is now being handled by the Sacramento shaft.

Calumet & Arizona and Superior & Pittsburg—The April output was approximately 4,500,000 lb. of copper.

Wolverine & Arizona—After five years' work the first shipment of 500 tons of copper oxide was made recently. The ore contained about 11 per cent. copper.

GILA COUNTY

Inspiration—At a depth of 100 ft. a body of copper sulphide was encountered. The ore is about 12 ft. thick and is said to average 3.72 per cent.

MARICOPA COUNTY

Octave—Electric hoists are being installed in place of the steam hoists now in use. The enlarged mill will be ready for operation within three months.

MOJAVE COUNTY

Gold Road—Manager J. L. Phillips expects to begin stoping on June 1, or as soon as the electric-power line from Kingman is installed. On the 500-ft. level of shaft No. 1, the development work of the past year has opened up an oreshoot 1000 ft. long and an average width of 12 ft. Chutes are being built. The grading and foundations for the new 40-stamp mill, tube mills and Butters filter process are about completed, and it is expected that the plant will be in operation Oct. 1.

Tom Reed—The new hoisting equipment at No. 2 shaft is in place, and the work of sinking will be resumed at the 250-ft. level. Contracts for grading for the foundations of a modern slime plant, to replace the present mill, have been let. The new 80-ton mill is expected to be in operation in three months.

YAVAPAI COUNTY

Yavapai Water, Oil and Mining Company—A new company recently incorporated by William Lee, Frank Pederson and others; capitalized at $1,000,000; principal place of business, Jerome; place of operations will be near Jerome Junction, where prospecting for water and oil will be carried on. A carload of machinery is ready for delivery.

Arkansas & Arizona—The diamond drill recently purchased is being installed in the 600-ft. level, and 450 ft. from the working shaft.

North Verde—Three shifts of men are employed. This was made possible by the installation of the new Cameron No. 9 station pump, which is handling the water easily. Sinking will probably be continued to a depth of 1000 feet.

Mescal—It is confidently expected that work will be resumed during the coming month. The Arizona Power Company will, by that time, be prepared to deliver power to its consumers in this district.

Yarnell—A new company has secured this old gold mine. The 20-stamp mill will be remodeled. C. J. Price is president; T. J. Sparks, general manager.

California

BUTTE COUNTY

Bills—Quite an important strike has been made in this gravel mine on the old Blue Lead channel in Bangor district, 14 miles from Oroville.

CALAVERAS COUNTY

Bouvard Extension—Thompson & Smith have resumed sinking on this mine near Angels and the pumping plant has been increased in capacity.

Reiner—The new 20-stamp gravel mill has been completed. The Cornish pump in the shaft will be run by steam, but the other machinery will have electric power. Superintendent John C. Benson has a large force of men at work. The channel will be drifted from the bottom of the new three-compartment shaft.

EL DORADO COUNTY

Alliance—This property near Newtown bonded to Burger, Benton and other Stanislaus county men, is having built a new gravel mill with a capacity of ten tons hourly. The body of gravel recently struck runs $3 per cubic yard. A new tunnel is being run. Rich quartz has been found in the same vicinity by the same men.

Cambrian—This mine near Coloma, idle for several years, is to be reopened under superintendence of C. E. Seymour.

Captain Ames—This old gravel claim in Chili ravine, idle for years and supposed to be worked out, has been reopened by Marshall & Harris and they are now taking out gravel worth $3 a carload.

Crown Point—James Richards is reopening this mine which has not been worked for some years.

HUMBOLDT COUNTY

Salmon Summit—At the annual meeting at Arcata it was decided to complete the erection of a small stamp mill and begin active development of the mines at Salmon Summit. F. A. Smith is secretary of the company.

INYO COUNTY

Red Rose and Ivanhoe—Ore is now being crushed in the arrastre of E. G. Rudolph which is driven by an overshot wheel.

Sacramento Mines Company—This company in the White mountains, 15 miles from Bishop, is having its machinery put in shape for increased development.

KERN COUNTY

Sidney Annex—Good ore is being milled. A new compressor has been added to the equipment. The mine is three miles from Johannesburg, and as owned by D. V. A. Williams.

MARIPOSA COUNTY

Sarle—The new quartz mill has been started up on ore from this mine.

MODOC COUNTY

Sunshine Group—Schaeur, Bassler & Laughlin, leasers, have been shipping ore to the Grigsby mill which averaged over

$100 per ton. Drifts are being run on the vein.

NEVADA COUNTY

Nichols—The pump has been started and as soon as the mine is unwatered and some development work done, values are to be determined.

Oustomah—This mine at Nevada City is yielding $40 ore at present. The shaft, now about 1000 ft. deep is being sunk deeper.

PLACER COUNTY

Three Stars—Superintendent A. Maltman has pumped out the Belmont shaft at Ophir, and as soon as the hoist is in order, will begin development work.

SACRAMENTO COUNTY

Stroup—On the new quartz mine being opened on the Uriah Stroup place near Folsom, a pump has been installed in the 135-ft. shaft, and increased development work may now be done.

Colorado

LAKE COUNTY—LEADVILLE

Iron Silver—An aërial tram is to be installed on the Tucson mine, to transport the ore 1200 ft. to Graham Park, to which point the railroad will extend the switch. A steady output is being maintained by the North and South Moyer and the Tucson mines; daily shipments are also being made from the Moyer dump.

Tenderfoot—The ore recently opened at a depth of 150 ft. has developed into a well defined shoot from which 30 tons daily are being shipped.

Big Six—Fourteen cars of iron ore were shipped last week from this property on Breece Hill.

Alps & Aztec Consolidated—It has been decided to develop the group of claims owned by this company on east Ball mountain, by means of a tunnel. The shaft on the Champion claim, however, will be continued. It now has a depth of 230 ft. Electric power is to be installed.

Silent Friend—A lateral is being driven to connect with the Yak tunnel through which the ore will be shipped.

Valley—Heavier machinery is to be installed after which the output will be doubled.

SAN JUAN COUNTY

Silverton Smelter—The old Kendrick-Gelder smelter, owned by the Ross Mining and Milling Company, has been sold to W. B. Lowe, of New York, the consideration named being $60,000. This plant is only equipped for copper smelting but it is stated that a lead furnace is to be added and the plant put in operation this summer.

TELLER COUNTY

Union Leasing Company—This company, operating the Gold Dollar Consolidated, Prince Albert, two blocks on El Paso, Pinto, Deadwood, Mountain Monarch and North Star mines, is credited with a production during April of 2100 tons of a gross value of $57,000.

Gold Coin—A strike is reported of 2 ft. of ore running 3 oz. in gold to the ton. This mine has produced about $6,500,000 in the past, and is situated within the corporate limits of the town of Victor. It is now operated by 30 sets of lessees and the April output is given at 2000 tons of $30 ore.

Modoc—Smelting ore has been encountered on the 900-level of this mine.

Drainage Tunnel—The deep drainage tunnel has now been driven a total of nearly 8500 feet.

CLEAR CREEK COUNTY

Humboldt—This property on Ute creek, has sent a $9000 bar of bullion, the product of a 30-day run, to the Denver mint.

Gem—A strike of 18 in. of high-grade silver-lead ore was made on this mine which is worked from the Newhouse tunnel.

Silver Horn—A body of gray copper ore, running high in silver, has been disclosed in an old stope in this mine on Ute creek.

Burns-Moore Tunnel—It is expected that this tunnel, the portal of which is in Chicago creek, and which is already driven 4000 ft., will during this year tap the Silver Horn and other former large shippers that closed down on account of the large volumes of water encountered.

Georgia

BARTOW COUNTY

Pittsburg-Bartow Mining Company—This company controls a tract of 600 acres of ore land and has practically completed the necessary construction work for active mining, including a tipple and sidings and the installation of loading and mining machinery. The plant has also been equipped with pumps and pipe lines, as the ore is such that some washing is required. The mine will be open-pit. The company expects to be shipping ore about the middle of May. For the present the company will sell its product as merchant ore to southern furnaces, but eventually other manufacturing operations are expected to be carried on. Thorough soundings and investigations of the deposits have been made and these show that a large block of ore is in sight. Geo. M. Koehnline, Wheeling, W. Va., is president and general manager of the company, and Walter Kennedy, Pittsburg, is serving as consulting engineer.

Idaho

SHOSHONE COUNTY

Black Horse—A 12-in. vein of rich zinc ore was encountered in a drift 400 ft. from the end of a 900-ft. tunnel.

Blue Bell—A contract was let recently for another 100 ft. of drifting.

Bunker Hill—A suit was recently commenced against this company by the Springston Lumber Company for the recovery of the value of certain logs alleged to have been appropriated by the mining company.

Pittsburg Lead—The suit of Joseph P. Keane against the Pittsburg Lead Mining Company involving the ownership of 20,000 shares of stock has been decided in favor of the defendant. A notice of appeal has been served.

Sheridan—Fourteen inches of good milling ore was recently opened at a depth of 200 feet.

Monarch—It is reported that the 75-ton mill will be increased to one of 250 tons capacity. To date nearly 1000 tons of concentrates have been shipped.

Indiana

SULLIVAN COUNTY

In a formal sale of the John R. Walsh and J. K. Seibert mining properties in this and Greene county, the bondholders represented by the Equitable Trust and Savings Company, of Chicago, purchased the property for $1,500,000. The bid made by the bondholders was the only one, the only other formidable competitor, the United States Steel Corporation, having been blocked from the deal.

The sale was made at 10 a.m., May 1, on the court-house steps in Sullivan, and the deal was consummated soon afterward. The sale includes more than 15 of the best mines in the territory, and the name will be changed from the Indiana Southern & Southern Indiana Coal Companies, to the Alliance Coal Company. The new company will have complete control of more than 20,000 acres of valuable coal lands in Sullivan and Greene counties.

Michigan

COPPER

Lake navigation has opened after an extended blockade by ice at the Soo. Boats are at the Calumet & Hecla docks, and also the Copper Range, loading with copper.

Michigan—The old adit on the Bee tract has been driven about 80 ft. and throughout its length good copper ground has been revealed. This opening lies about 2500 ft. east of "C" shaft and the strike is about 90 ft. north of the Calico vein.

Mass—It is planned that within 3 months the mine will be able to ship about 500 tons daily to the mill.

Lake—Drifting at the end of the crosscut driven from the 3d level to open the

formation is underway. This drift is in 70 ft. and shows a very fine state of mineralization throughout. The north drift from the second level is also in good ground. It is expected that in the near future this company will issue 10,000 shares of stock at $25 per share to provide working capital.

Adventure—This company has decided upon the site for its new shaft to expose the three lodes that were cut by the drill cores. All the necessary machinery to handle this work is on the ground and sinking will be under way early in May. It is proposed to sink this shaft vertical until the first lode is cut, and then turn the shaft to conform with the pitch of the vein.

Ahmeek—The two new shafts are down over 200 ft. and are sunk at an angle of 80 deg. until the lode is reached, when they will turn to the angle of the formation. They start from a central point and diverge. It is expected that the Kearsarge lode will be cut at about 1200 ft. The lower levels of the two producing shafts are encountering some fine mass and heavy stamp copper. These shafts are equipped with a very efficient skip-loading device. On a trial run recently 148 five-ton skips were hoisted in eight hours. The framework of the stamp mill is completed and the building is rapidly being inclosed and, barring some unforseen delays, will be ready to handle rock early the coming fall.

Elm River—The report for the year ending March 31, 1909, states that the development work during the year was 750 ft., in shafts and crosscuts. The treasurer's report Jan. 1, 1909, shows mining and general expenses, $34,984; receipts from interest and rent, $3,402; balance on hand, $54,760.

Tamarack—At the annual meeting, May 6, the management was transferred to the Calumet & Hecla Mining Company by the election of a new board of directors as follows: Rudolphe L. Agassiz, Quincy A. Shaw, George A. Flagg, Alexander Agassiz, Francis W. Hunnewell, Francis L. Higginson and James McNaughton.

New Arcadian—The new company has filed articles of association. The formal transfer of the Arcadian property to the New Arcadian will be made within the next few days.

North Lake—This company has exposed three copper bearing lodes on its lands by means of drill cores, one lode being 30 ft. thick and showing about 10 ft. of good copper rock.

Atlantic—This company continues sinking its Section 16 shaft and a depth of about 2200 ft. has now been obtained. No material change is being noticed in the character of the formation. Several of the drifts are in nearly 500 ft. from the shaft without encountering any consistent run of paying ground. The best showing to date had been made in the lateral openings from the 13th and 15th levels.

Missouri

St. Francois County

The strike of the miners for an advance of 30c. per day has spread to all the mines in the Flat River lead district, excepting the Deslodge and National Lead Company mines. As the Miners' Union is not well organized in this district, the strike is not expected to last long; thus far the men have been quiet and peaceable. Many of the old miners are leaving for Joplin and other mining camps.

Montana

Butte District

Amalgamated—Trouble with the gases generated by smouldering fires in the old stopes of the Anaconda Copper Company properties has increased within the past week. Operations have recently been practically suspended in the Anaconda, St. Lawrence, Neversweat and Parrot mines on account of the gas. At the annual meeting of stockholders of the Boston & Montana Mining Company, held recently in Butte, the following were elected directors for the ensuing year: Sidney Chase, John D. Ryan, B. B. Thayer, David B. Hennessy and Andrew B. Grafuis.

Butte Central Copper Company—Work on the Ophir claim, preparatory to the resumption of operations, has been started. It is expected that by June 1 the work of sinking the shaft from the 500- to the 1000-ft. mark will be started.

Beaverhead County

Gilmore & Pittsburg Railroad—The road is being built between Armstead, in Beaverhead county, and Gilmore, Idaho. Two locomotives and about 20,000 tons of steel rails have recently been ordered. It is possible that the road may be in operation by Jan. 1, 1910.

Fergus County

Cumberland—A. S. Wright has secured an option on this property, situated at Maiden.

Gallatin County

Gallatin Valley Electric Railway—Some work has been done on the grading for the new road. Charles B. Anderson, secretary of the company, is in Spokane for the purpose of purchasing machinery.

Storrs Mines—E. A. Bartel has secured a lease on the coal mines of the Amalgamated Copper Company at Storrs, and will begin operations within a short time. The mines have been closed down for several months.

Granite County

Hell Gate Coal Company—This company has recently been incorporated with a capital stock of $250,000. The properties are situated at Hell Gate. The following are the incorporators, all being residents of Missoula, Montana: Henry L. Shapard, William W. West, John J. Murphy, John E. Kane, Joshua Fleming, William Crawford and Walter W. Murphy.

Missoula County

Monitor—This property, situated at Saltese, has been closed down for the last two months. It is reported that operations will be resumed by June 1.

Montana-Clinton Company—This company has recently been organized to take over the property of the old Triangle Mining and Development Company, situated at Woodville gulch.

Nevada

Esmeralda County—Goldfield

Florence—The ore reserves are constantly being increased by new discoveries showing high grade, milling and shipping ore. The production of the mill for the month of April was lower than previously estimated due to accidents to machinery.

Consolidated—A shipment of one carload a day of high-grade ore is being made from the Hampton stope, one carload consisting of 33 tons gave returns of 72.84 oz. gold per ton.

Esmeralda County—Horn Silver

Great Western—In the winze being sunk from the 300-ft. level, 3½ ft. of ore was discovered last week. The mine is maintaining its regular shipment of three carloads per week.

De Votie Lease—A shipment of 16 tons of ore will be sent out this week.

Horn Silver Townsite Company—A contract was made last week for the sinking of a well. It is expected that a good supply of water will be obtained at a depth of 700 feet.

Nye County—Bullfrog

Montgomery-Shoshone—A body of good gold ore was recently opened between the third and fourth levels from which shipments are now being made. Stoping is carried on at the 500 level of the Polaris vein, from which a good grade of milling ore is being taken. Two machines are at work in the Glory Hole, the boundaries of which have not been reached. Additions are being made to the mill equipment and more machinery is expected to arrive about May 20.

Nye County—Pioneer

Pioneer Lease—Shipments of ore are maintained at the rate of 75 to 100 tons per day. At present six machine drills are being operated, two on the 156-ft. level and the remaining ones in the big stope on the lower level. The 12-drill

compressor plant has arrived and is being installed.

NYE COUNTY—TONOPAH

MacNamara—The main shaft was completed to a depth of 790 ft. April 25, and last week a station was cut at the 775-ft. level; a crosscut was started for the vein which was recently cut by the shaft.

Montana-Tonopah—The crosscut in the foot wall of the Triangle vein in the stope from the 390-ft. level has developed between three and four feet of high-grade milling ore. The drift on the Martha vein on the 515-ft. level is in continuous ore, with occasional bunches of high grade. The mill is making an extraction somewhat under the average, due to oxydized ore. Several improvements are now under way which it is thought will remedy this defect.

New Jersey

SUSSEX COUNTY

Lafayette Slate Company—This company has been incorporated to work the slate quarry at Lower Lafayette. The office is in Newton, and the incorporators are A. J. Graey, L. H. Morris and F. R. Snyder. The quarry has been opened for some years; the new company will extend the workings.

North Carolina

ASHE COUNTY

Standard—The Standard Mining and Milling Company was recently incorporated at Asheville. Capitalization, $20,000. Incorporator, R. S. Smith.

CHEROKEE COUNTY

Alba Mineral Company—This company was recently chartered at Kinsey to acquire and develop mining property. Capitalization, $10,000. Harold Smith, of New York, and others are interested.

CLEVELAND COUNTY

Catawba—Work is being done at the old Catawba gold mine near King's mountain. It is reported that a movement is on foot to resume work at the old tin mines in this vicinity.

JACKSON COUNTY

Consolidated Nickel—Machinery for this mine is now being freighted from the railroad. A 900-h.p. Corliss engine is being installed. The power house is 95x95 ft.; boiler room, 50x50 ft.; wareroom, 80x30 ft. Work of construction is under the direction of A. S. Watson and J. G. Van Hurst, of New York. G. A. Adams is head of the company.

South Carolina

ABBEVILLE COUNTY

Saluda Copper Company—It is reported from Anderson that work is actively being carried on at this property. The mine is near Donalds. A consignment of machinery has been received.

CHEROKEE COUNTY

Flint Hill Mining Company—This is a new company recently organized at Gaffney with a capital of $250,000. L. U. Campbell is president and general manager. It is reported that a system of modern machinery will be installed at an early date.

South Dakota

CUSTER COUNTY

There is now little doubt that tin mining on a large scale will be carried on in the Black Hills, provided careful prospecting and development bear out previous indications and reports. The Harney Peak Tin Mining, Milling and Manufacturing Company has been reorganized under the laws of Maine. Dr. A. R. Ledoux, for 15 years receiver for the old company, has been given the management under the new company.

LAWRENCE COUNTY

Lucky Strike—On May 5 the new mill was started. Twenty of the 30 stamps are now dropping and the management reports enough ore in sight to insure continuous running at full capacity.

Utah

JUAB COUNTY

Tintic Central—As soon as the power plant completes its connections, the new hoisting plant will be put in operation. The shaft is now at a depth of 235 feet.

East Tintic—The new plant, consisting of a 50-h.p. engine, 100-h.p. boiler, 5-drill compressor and a 50-light electric plant is now in full operation. Work has been started in the shaft and stations will be cut at the 130- and 230-ft. levels.

McKinley—The stock of this company will soon be listed on the Salt Lake Exchange. A winze is now 75 ft. below the 500-ft. level, and the shaft is to be continued and crosscutting done on the lower levels. The property is situated west of the Centennial Eureka mine.

Beck Tunnel—The ore, now being sent to the smelter is taken from the old workings and from the 300-ft. level of the new workings.

Virginia

TAZEWELL COUNTY

Big Vein Pocahontas Coal Company—This company has leased the Browning properties and will extend the present workings, putting up new buildings and machinery. The company was recently organized in Baltimore; A. D. Macfarland is engineer in charge at the mines.

Washington

Col. C. Christopher and associates of Seattle have purchased, from the State Mining and Smelting Company, the patent rights of the Cotton matting furnace for the States of California, Oregon, Nevada, Arizona and New Mexico.

LEWIS COUNTY

Mendota Coal and Coke Company—Twenty dwellings are to be erected for the use of the employees at the mine at Tono. The camp will have a water system, school house and other improvements, thus indicating a permanency of coal-mining operations at this point.

Wyoming

CARBON COUNTY

United Smelters, Railway and Copper Company—Treasurer I. N. Nennock announces that more than 85 per cent. of the outstanding stock of the Penn-Wyoming has been sent in and exchanged for securities of the new company. This means that more than $7,500,000 par value of the Penn-Wyoming stock is now owned by the new company. The Penn-Wyoming is capitalized at $10,000,000, but of this only $8,963,000 was issued.

Philippine Islands

BENGUET

Benguet Consolidated Gold Mining Company—This company reports for February a production of 150 oz. gold and 200 lb. cyanide bullion.

Paracale Gold Dredging Company—The dredge returns for February show a return of 630 oz. gold.

Philippine Gold Dredging Company—The new dredge of this company is now being installed on the Paracale river, above that of the Paracale Dredging Company.

CAMARINES

Much prospecting is going on, according to the *Far Eastern Review*, of Manila, and the indications are that there will be much activity in placer mining this year.

Delabaybay Dredging Company—The machinery for the gold dredge has been received, and is being put together.

San Manricio—Preliminary work is being done for the 20-stamp mill at Mambulao. The old workings in the mine have been cleared out and retimbered. About 1500 ft. of development work has been done.

Tumbago—Preparations for active work are well advanced. The old workings have been cleared out and are being extended. A five-ton Huntington mill will soon be ready to run. A stamp-mill will be added later, if results prove as favorable as expected.

Canada

ALBERTA

Canadian-American Coal and Coke Company—General Manager Muller, at

Frank, is opening two levels from the shaft sunk earlier in the year, at 240- and 350-ft. depth, respectively. The headings are in a seam of clean coal varying from 10 to 14 ft. in thickness. These new workings will add 200 tons per day to the output, making about 700 tons in all.

British Columbia

G. O. Buchanan, of Kaslo, supervisor of lead bounties for Canada, has announced that the total amount earned as bounty on lead mined in Canada during the fiscal year ended March 31, 1909, is $307,433, this representing the bounty paid by the Canadian government on an output of 41,986,475 lb. lead. Revised official figures show a production of nearly 43,200,000 lb. of lead in British Columbia in the calendar year 1908.

British Columbia—Lardeau

Ferguson Mines, Ltd.—F. C. Merry, of Ferguson, superintendent, has resumed shipment of ore from the Silver Cup mine, navigation on Trout lake being once again practicable after the winter freeze-up. Last year's output was about 1560 tons averaging more than 100 oz. silver per ton and nearly 30 per cent. lead.

British Columbia—Nelson

Eureka—After tunneling about 700 ft. about 10 ft. of good copper ore has been encountered at a depth of approximately 300 ft. below the surface.

Ontario—Cobalt District

Ore Shipments—Shipments of ore from Cobalt for the week ended May 1 were: Buffalo, 44,620 lb.; Cobalt Central, 43,270; Chambers-Ferland, 40,000; La Rose, 254,500; McKinley-Darragh, 57,340; Nipissing, 120,660; O'Brien, 128,018; Temiskaming, 132,800; Trethewey, 191,988; total, 1,013,196 pounds.

La Rose—The number of men employed is 260, and large additions to the force will be made during the next few weeks, when active development of the Lawson, Princess and University is undertaken. Very rich ore is being taken from No. 3 shaft, averaging 10,000 oz. to the ton. The vein at the bottom of the shaft shows 5 in. of this grade in addition to wall-rock rich in native silver. A raise has been made from the level in MacDonald tunnel 80 ft. to the surface and stoping has been started.

Yukon

The new Herbert district, tributary to Forty-Mile, including also Little Dome creek, is also the scene of much activity as indicated by the applications at the gold commissioner's office for ground. A good development is predicted.

Yukon Basin Gold Dredging Company—A gold dredge with a capacity of 3000 cu.yd. per day, for use in the Klondike, has been shipped from Vancouver, B. C., to Skagway, Alaska, whence it will be taken to its destination on Stewart river. It is of a New Zealand type, was manufactured in Glasgow, Scotland, and prepared for shipment north at Vancouver. The company has large concessions along Stewart river.

Mexico

Chihuahua

Parral Output—The production of the camp for the week ending April 30 was 9120 tons, of which 5650 tons were of milling grade and were treated locally.

New Camps—Two new camps, the Vallecillo and Real de Nogales, in the municipality of Zargosa, Hidalgo district, readily reached from Parral, are giving considerable promise. The former shows ores of copper-gold content and the latter lead-silver.

Rio Plata—The report of March operations contains the following items; Net returns on shipments of concentrates and crude ore, $26,671; operating expenses, $8000; paid account mine indebtedness, $18,670 leaving an indebtedness of $31,275 on the mine.

Mexicana—Geo. B. Jacobs and associates are sending out from this mine in the Cerro Colorado section, near Ahumada, a small tonnage of high-grade lead-silver ore. It is the intention to install machinery shortly.

Mexico

Mexico Mines of El Oro, Ltd.—Report for April: Yield of bullion, $110,120; total expenses, $45,540; profits, $64,570; expenditures on permanent improvements, $1000; net value of 20 tons shipped during month not included in the above profit, $6570.

El Oro Mining and Railway Company, Ltd.—Report for April: Yield of bullion, $215,190; total expenses, $130,410; profit, $84,780; profit on railway, $4000; total profit, $88,780; expenditures on permanent improvement, $8000.

Central America

Costa Rica

Aguacate Mines—At these mines, San Mateo, a 100-stamp mill is being erected under charge of Thomas D. Murphy. The Pardy Engineering Company is putting in a hydroelectric plant, which is expected to furnish 4500 h.p. The mines are in charge of A. M. Yonge as general superintendent.

Africa

Rhodesia

Gold output in March was 48,030 oz. fine, being 2286 oz. more than in February; for the three months ended March 31, the total was 142,395. By values the reported production was $2,879,275 for the first quarter of 1908, and $2,916,692 in 1909; an increase of $162,583 this year.

Other production reported in March includes 20,454 oz. silver, 72 tons lead, 9 tons copper, 2730 tons chrome ore and 24 tons asbestos. Coal mined was 11,859 tons.

Transvaal

The mine labor report for March shows that at the close of the month there were at the mines 162,043 negro laborers and 9997 Chinese. This was an increase of 4205 negroes and a decrease of 37 Chinese during the month. As compared with March, 1908, there was an increase of 32,183 negroes and a decrease of 16,507 Chinamen. The new laborers coming to the mines at present are chiefly from Portuguese territory.

The gold production of the Transvaal in April is reported at 607,100 oz. fine, a decrease of 399 oz. from the March report. For the four months ended April 30, the total output was 2,242,992 oz. fine in 1908 and 2,395,432 oz.—or $49,513,579—in 1909; an increase of 152,440 oz. this year.

West Africa

Gold production of the Gold Coast and Ashanti in March, is reported at 23,186 oz. bullion, being 1783 oz. more than in February. For the three months ended March 31, the total was 76,924 oz. bullion in 1908, and 67,406 oz. in 1909; a decrease of 9518 oz. The bullion reported this year was equal to $1,318,270, or 63,777 oz. fine gold.

Australia

New South Wales

Broken Hill Proprietary Company—In the controversy between this company and its men, the company has given notice of an appeal. The appeal is not against the schedule of wages fixed by the Conciliation and Arbitration Court, for the law does not permit of objection on that score. But the court included in its award the decisions regarding two matters extraneous to the plaint. First, that the number of shifts at Port Pirie be reduced from seven to six per week; and, secondly, that there shall be no extension of the contract system beyond the point to which it is at present applied. The hearing on this appeal was expected to delay for some time the resumption of work.

New Zealand

The Mines Department reports the exports of gold in February at 41,265 oz. For the two months ended Feb. 28 the total was 92,515 oz. bullion in 1908, and 77,230 oz. in 1909; a decrease of 15,285 oz. The bullion reported this year was equal to $1,507,285, or 72,923 oz. fine gold.

Exports of silver for February were 154,258 oz. For the two months the silver reported is 244,594 oz. in 1908, and 198,684 oz. in 1909; a decrease of 45,910 oz. this year.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, May 12—Coal trade in the West continues to advance, though still rather slowly. The Lake trade is still in some doubt, owing to the late beginning of shipments and also to the controversies over rates on coal to Lake Erie ports, which are still unsettled. The demand for steam coal, however, is undoubtedly better than it was a month or so ago, though the trade is still backward enough to cause sharp competition for orders.

It is reported that the Steel Corporation has decided after all to make a large quantity of coke at Gary for the use of its plants there. It is also understood that the Corporation has secured control of a number of Indiana mines for the purpose of supplying the coal for use in that plant.

In the East the bituminous trade is less active than in the West and there is a good deal of complaint about the dullness in Seaboard territory and New England.

The report that the Pennsylvania Railroad Company has secured the stock in the Chesapeake & Ohio, which has been on the market for some time has tended to quiet the discussion over the competition of West Virginia coals in the Seaboard trade. It is generally believed that with the Norfolk & Western and the Chesapeake & Ohio both under Pennsylvania control, rates will be equitably adjusted. The Virginian railway, whatever it may do in the future, is not yet in a position to make heavy shipments.

The anthracite trade, now that all strike troubles are over, has settled down into the quiet usual at this season. Domestic trade is fair and the companies are preparing for the usual summer shipments to the West. An incident in this trade is the reported cutting of prices at Springfield and other leading points in the central part of New England. The trade there has been mainly in the hands of the New York, Ontario & Western, which is controlled by the New York, New Haven & Hartford company. It is said that this company has resented some attempts of the Erie to secure trade in what it has regarded as its special territory and has cut quotations accordingly to drive out the so-called intruders. This action is rather characteristic of the New Haven company.

Ohio Railroads and the Hepburn Law—The Interstate Commerce Commission has been making an investigation into the ownership of coal-mining companies by the Hocking Valley and other Ohio and West Virginia railroad companies; also into some charges of discrimination in coal rates and shipping facilities on those roads.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to May 1, short tons:

	1908.	1909.	Changes
Anthracite	1,798,691	1,778,316	D. 20,375
Bituminous	10,886,619	11,716,037	I. 829,418
Coke	2,326,077	3,306,992	I. 980,915
Total	15,011,387	16,801,345	I. 1,789,958

The increase for the week was 192,233 tons. Total increase, year to date, was 11.9 per cent.

Anthracite coal shipments in April were 5,891,176 long tons, being 441,198 tons less than in March. For the four months ended April 30 the shipments were, in long tons:

	1908.	1909.	Changes.
Reading	3,911,998	4,555,959	I. 643,961
Lehigh Valley	3,500,040	3,551,618	I. 51,578
N. J. Central	2,735,067	2,734,096	D. 971
Lackawanna	3,176,498	3,179,787	I. 3,289
Del. & Hudson	2,279,469	2,239,202	D. 40,267
Pennsylvania	2,023,907	2,070,596	I. 46,689
Erie	2,337,552	2,694,373	I. 356,821
N. Y., Ont. & West.	910,943	957,368	I. 46,425
Total	20,875,474	21,982,999	I. 1,107,525

The total increase this year was 5.3 per cent. Six companies showed gains, those of the Philadelphia & Reading and the Erie being the largest. Two companies—the Delaware & Hudson and the Central Railroad of New Jersey—had decreases, the latter being very small.

New York

Anthracite

May 12—Trade at present is dull, owing to the fact that many large consumers laid in extra stocks during March in anticipation of a possible stoppage of production. Now that the labor troubles are settled they will use up these stocks before purchasing more coal. Quite a number of the colleries in the anthracite region are running short time, and this condition may last for a month or more.

Prices on domestic sizes are $4.35 for lump and $4.60 for egg, stove and chestnut, f.o.b. New York harbor. For steam sizes current quotations are $3.10@3.25 for pea, $2.35@2.50 for buckwheat, $1.70 @2 for rice, $1.25@1.50 for barley, f.o.b. New York harbor. Washery pea can be had for 5 or 10c. less.

Bituminous

The Seaboard bituminous trade is unmistakably dull. Few orders are coming from the far East, although most people believe that that section is pretty near bare of coal. Along the Sound there is a regular business, but it is much smaller in amount than is usual. New York harbor is rapidly becoming a dumping ground, where purchasers are watching for bargains in the way of cheap coal. Prices continue unchanged. All-rail trade continues about on the same level as for several weeks past. Transportation is good and car supply abundant.

There is some inquiry for coal for outside shipments to Southern ports, chiefly Gulf ports, and a fair quantity of coal is being sold for such shipments.

In the regular Coastwise trade there is not much doing, and vessels are in good supply, being inclined to hunt for cargoes. Rates for large vessels from Philadelphia are: To Boston, Salem and Portland, 55c.; Portsmouth, 70c.; Lynn, Newburyport and Bangor, 75c.; Providence, New Bedford and the Sound, 55c. per ton.

Birmingham

May 10—The Alabama coal market is still dull and the production is about 50 per cent. off. Some of the principal mines of the State are running on half-time, while some of the commercial mines are on less. There is much complaint among the mine workers. Sales agents of coal companies are working hard in the pick-up orders but they are not so easily found. The coke demand is steady in the furnace quarters. Foundry coke is in fair demand. The coke production holds up fairly well.

Chicago

May 11—Cool weather following a spell of summer temperature has helped the domestic trade in the last week, and steam consumption fully holds its own. The interest of the trade is largely in contracts, many of which are being made at low prices; this assures a good movement of coal, and open-market conditions will continue to dominate the trade. The general supply is so well regulated that demurrage evils are largely suppressed, while confidence of consumers increases.

Illinois and Indiana coals are unchanged in price, carlots of lump and egg selling at $1.75@2.25; run-of-mine at $1.65@1.75 and screenings at $1.40@1.70. Eastern coals are in good condition, only Hocking showing some over-supply and selling at $2.85@3.15. Smokeless is in steady demand at $3.30@3.45 for lump and $2.95@

3.05 for run-of-mine. Youghiogheny is steady at $3.15 for ¾-in. lump and Pittsburg No. 8 somewhat dull at $2.75@2.85. Anthracite is selling well under the stimulus of the cool weather and generous advertising of April prices.

Cleveland

May 11—Lake coal trade drags yet, the shipments being slow. There is much interest in the controversy over freight rates to Lake ports. The strike is making a good deal of noise, but does not seem to delay the sailing of vessels.

Domestic trade is naturally slow, but there is some buying by dealers. Massillon is quoted at $2.30 for lump and $2.15 for run-of-mine at mine.

Steam coal is more active and sales are larger. Slack is in rather good supply. Ordinary grades of steam coal sell at $1.35 for lump and $1.10 for run-of-mine, at mines; smokeless, $1.50 and $1.20 at mine. Kanawha coal is offered here at $1.35 for lump and $1 for run-of-mine at mine.

Indianapolis

May 11—The change in ownership of the John R. Walsh coal companies—the Indiana Southern and the Southern Indiana—which were sold under order of court a week ago, will mean a resumption of work in at least a score of mines in Sullivan and Greene counties within the next four weeks. The mining property was bought by Chicago men, who are said to be identified with both the Steel Corporation and the Illinois Central railroad. Either the Steel Corporation, it is reported, will take over about 15 mines, or will place large contracts for coal to be used in the Gary plant with the mines in question. In either event, resumption of work in mines that have been idle for the past two years is certain. The Illinois Central has made offers for mines at Farnsworth, Dugger and Linton, on the line of its Indianapolis-Effingham branch.

The general mining situation in Indiana is far better, as a whole, than for a year or more.

Pittsburg

May 11—Lake shipments are light, as very little ore is coming down. One ore and coal interest has been making fair shipments, while the railroads are shipping some coal across the Lakes. Prices continue low and unsatisfactory, and the market is a trifle weaker than it was a fortnight ago. Ordinary lots of mine-run are selling at about $1.10, while on large lots $1 is done and occasionally shaded. Slack remains at 55 to 65 cents.

Connellsville Coke—It is regarded as certain that the Connellsville coke merger will be put through, but it will not include all the independent interests. The project is backed by two Pittsburg banks which can swing the deal without difficulty. While on the surface the project is merely one to consolidate independent coke interests, it is believed in well informed quarters that the real motive in the operation is to get the coke operations together to form an adjunct to the consolidation of independent steel interests which has been worked upon in a more or less desultory fashion for about six months.

Standard Connellsville furnace coke is selling at $1.50@1.60 for prompt shipment, while $1.75@1.90 is quoted on second-half contracts. Spot foundry coke is held at $1.75 and contract at $2@2.25.

The *Courier* reports the production in the Connellsville and lower Connellsville fields at 229,507 tons, a drop of less than 1000 tons from the previous week. Shipments were 9061 cars, an increase of 76 cars, and divided as follows: to Pittsburg district, 3972 cars; to points west of Pittsburg, 4249 cars; to points east of Connellsville, 840 cars.

Foreign Coal Trade

Belgian Coal Trade—Imports and exports of fuel in Belgium, three months ended March 31, metric tons:

	Imports.	Exports.	Excess.
Coal.....	1,400,670	1,189,385 Imp.	211,285
Coal, 1908...	1,139,121	1,050,805 Imp.	88,316
Coke.....	71,434	260,773 Exp.	189,339
Coke, 1908..	94,472	202,177 Exp.	107,705

The chief imports are from Germany and Great Britain; the chief exports to France.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on May 1: Best Welsh steam, $3.90; seconds, $3.78; thirds, $3.60; dry coals, $3.66; best Monmouthshire, $3.60; seconds, $3.48; best small steam, $2.88; seconds, $2.52. All f.o.b. shipping port. This is a sharp advance on all coals, varying from 18 to 24c. per ton.

Iron Trade Review

New York, May 12—The iron and steel trades continue to show a fair degree of activity. In various lines this amounts to a strong business, though in others there is still some lagging.

Pig-iron orders have increased in volume of individual orders and in the aggregate. Some foundries, quite a number in fact, are placing orders running into the third quarter and are showing a degree of confidence in future business which has not been manifested for a good while. Some large orders for basic iron have also been placed within the week. Pig-iron business has been more active in Eastern territory than in the West, however. The furnaces have accordingly stiffened somewhat in their views. They are not attempting to advance prices on current business, but are less inclined to make concessions; and many are asking a little higher price for third quarter deliveries than for spot iron.

In finished material structural steel continues the most active section of the market. A good business is also being done in bars, and the demand for plates is improving. Wire and wire products have been active since the reductions in price announced last week.

One large order for rails has been announced, the Chicago, Milwaukee & St. Paul Company having placed a contract for 63,000 tons of standard section with the Steel Corporation. The rails are to be rolled by the Illinois Steel Company. It is stated that the order was taken at the old price of $28 per ton, which would contradict the report that lower prices were to be made on rails. The business in light rails is increasing and the principal companies making them have advanced their prices $2 or $3. Recently there has been considerable competition for these orders and some had been taken as low as $22 per ton.

Pig-iron Production—The reports of blast furnaces, as collected by the *Iron Age*, show that the aggregate weekly capacity of the coke and anthracite furnaces in blast on May 1 was 413,700 tons, an increase of 4500 tons over the report for April 1. Making allowance for the charcoal furnaces, the production of pig iron in April was, approximately, 1,755,000 tons; for the four months ended April 30 it was 7,182,000 tons.

Electric Iron and Steel—The installation of Heroult electric furnaces in the Pit River district in California is reported to be past the experimental stage and ready to begin the smelting of iron and steel on a commercial scale. It will be the first working plant of the kind in this country.

Baltimore

May 11—Imports for the week included 4188 tons cupreous pyrites and 7835 bars converter copper from Spain; 17,700 tons iron ore from Cuba.

Birmingham

May 10—The pig-iron market in this section appears to be as strong as it was a month ago, if not stronger. There are some sales still being made and prices continue to hold strong, at $11.50@12, No. 2 foundry, the first named price being the minimum, with the latter secured by more than one furnace company. An estimate is made that over 450,000 tons of iron have been sold by Southern iron manufacturers since the middle of March. While much of this iron was sold at $11, it will mean steady operation for some time to come. The Tennessee company blew in two of its Bessemer, Ala., furnaces the past week and will have two

more ready in the Birmingham district before the end of the month.

The cast-iron pipe concerns in this district continue to secure business.

The steel plant at Ensley is being repaired. It is not believed the shut down will be long lived. Three thousand men were thrown out of steady employment, though many of the number are being employed in other parts of the district.

Chicago

May 11—The pig-iron market is unmarked by any change of importance, but evidently is strengthening day by day. Southern holds firmly up to $11.50 Birmingham ($15.85 Chicago) and on some sales for delivery late in the year $12 is obtained. Most of the buying is in small lots—up to 500 tons—but occasionally a 1000-ton lot is taken. Melters are as yet cautious about contracting for large supplies ahead. The increasing movement of iron and steel products has much to do with restoring confidence. Northern iron sells evenly at $16.50@17 for third-quarter delivery and with every prospect of increased demand. Both Northern and Southern appear to be settling into something of the usual summer quietness. Lake Superior charcoal iron is firm and quiet at $19.50@20.

In finished products general conditions are bettering. Lower prices have brought about large sales, railroad supplies and structural material especially showing improved demand.

Coke remains at $4.70 for the best Connellsville, with sales increasing but supply abundant.

Cleveland

May 11—An increased movement of ore from docks is noted. Nothing definite has been done as to new ore prices, and it begins to look as if there would be no change from last season. The unions have not yet succeeded in stopping vessels ready to start up the Lakes.

Pig Iron—Many small sales are being made, which foot up a big total tonnage. Furnaces are stiffer in their views and are not making concessions. Prices are about on a basis of $15@15.25 for No. 2 foundry.

Finished Material—There is a good trade in bars and structural steel. Plates are selling better, especially in small lots.

Philadelphia

May 12—The pig-iron market has developed a good deal of activity during the last few days. The heavy sales recorded at Southern furnaces have indirectly helped this market and in some instances makers are asking a trifle more money than a week ago. Basic iron is stronger than any other kind. Foundry, especially No. 2, has been taken quite freely, though in small lots. The mills continue to buy forge iron in a moderate way at 15c. Basic is quoted at the same price. Two or three good-sized lots of malleable iron were taken Monday. Special brands were quoted today for quick delivery 50c. higher than a month ago. The sentiment among furnace interests here is that there will be no more serious competition from the South.

Plates—A large business has been done in steel plates in the Pennsylvania mills.

Structural Material—A general improvement in structural material has set in and a large volume of business has been transacted, concerning which office men do not care to give any details. Orders for bridge-building material are dropping in every day or so.

Pittsburg

May 11—Another advance of $1 per ton has been made in bars, plates and shapes, making bars 1.20c. and plates and shapes 1.30c. These prices are now the minimum of the market for any delivery, and are not being made in any case for delivery beyond Jan. 1. The advance was made independently by the different producers. The first advance, about three weeks ago, was not a general one, as it represented rather the withdrawal of special prices by producers who had been most eager for business.

The latest advance puts the market on bars, plates and shapes back to where it stood immediately after the February break. However, it is less than three months since then and it is regarded as favorable that the market found bottom and made a partial recovery so soon.

The great bulk of the agricultural-implement business in steel bars has been placed, the latest business being booked last week, just before the advance. Usually this business is placed at a flat price, for deliveries July 1 to June 30, but this year the minimum prices were made only to Jan. 1, all contracts calling for some kind of an advance for 1910 deliveries, the price in some cases $1 per ton; while in other cases it was stipulated that the price should advance with the market, but not above a stipulated price.

A considerable part of the buying of finished-steel products in the past few weeks has been of a more or less speculative character, and one of the motives of the mills in advancing prices was to check this tendency.

Pig Iron—Basic iron is quoted at $14, Valley, for early delivery and has not been over-firm at that figure, while it is impossible to obtain an advance for delivery in the second half. Bessemer has been a trifle weak, and has sold in several cases at $14.50, Valley. Foundry iron is slightly firmer, owing to the withdrawal of several sellers at the $14 price, but iron can still be had at $14, Valley, for May and June delivery. For third quarter an advance is generally asked, but consumers are not disposed to pay any advance for forward delivery when stocks are as large as they are. On the whole the pig-iron market has not justified the more optimistic tone which was observable a week ago.

Steel—Deliveries continue good on old contracts, but there is scarcely any new business going as consumers are well covered. In the local market billets are firm at $23 and sheet-bars at $25.50, as formerly.

Sheets—Demand is only fair. The mills are running at 65 or 70 per cent. of capacity. Prices remain on the basis of 2.25c. for black and 3.25c. for galvanized, 28 gage, ordinary carloads, while on very attractive orders these prices are sometimes shaded $1 per ton.

Ferromanganese—The market continues rather weak, being quoted at $41, Baltimore, or $42.95, Pittsburg, for ordinary lots. On an attractive order this price could probably be shaded.

Foreign Trade in Iron and Steel

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for the three months ended March 31 are valued by the Bureau of Statistics of the Department of Commerce and Labor at $42,699,772 in 1908, and $35,151,008 in 1909; a decrease of $7,548,764, or 17.7 per cent. The leading items of export were, in long tons:

	1908.	1909.	Changes.	
Pig Iron	6,765	8,754	I.	1,989
Billets, ingots & blooms	50,450	24,407	D.	26,043
Bars	15,329	14,947	D.	382
Rails	35,425	50,791	I.	15,366
Sheets and plates	24,223	33,559	I.	9,336
Structural steel	33,592	24,628	D.	8,964
Wire	35,536	33,192	D.	2,344
Nails and spikes	12,147	12,472	I.	325
Pipe and fittings	27,267	31,565	I.	4,298

These increases and decreases were about evenly divided.

Iron and Steel Imports—Imports of iron and steel and of machinery into the United States three months ended March 31 were valued at $5,470,091 in 1908, and $5,807,463 in 1909; an increase of $337,372, or 6.2 per cent. Leading items of imports were, in long tons:

	1908.	1909.	Changes.	
Pig iron	29,129	31,415	I.	2,286
Scrap	1,510	1,313	D.	197
Ingots, blooms, etc.	2,261	3,339	I.	1,078
Bars	9,958	5,072	D.	4,886
Wire-rods	3,091	3,243	I.	152
Tinplates	15,544	11,791	D.	3,753
Sheets and plates	650	1,005	I.	355

The most notable change this year was the decrease in tinplates.

Iron Ore Movement—Imports and exports of iron ore in the United States, three months ended March 31, long tons:

	1908.	1909.	Changes.	
Imports	190,459	275,658	I.	85,199
Exports	19,815	20,023	I.	208

Of the imports this year 193,232 tons were from Cuba; the balance from Newfoundland and Spain.

Imports of manganese ore, three months ended March 31 were 71,894 tons in 1908, and 37,118 tons in 1909; decrease, 34,776 tons.

Metal Markets

New York, May 12—Many improvements in the current markets are reported, and the general feeling seems to be improving; sales are increasing.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Mar. 1909..	$21,252,462	$ 5,161,648	Exp. $16,090,814
" 1908..	1,447,206	3,649,407	Imp. 2,202,201
Year 1909..	37,978,632	12,158,275	Exp. 25,820,357
" 1908..	3,859,003	17,296,024	Imp. 13,437,021
Silver:			
Mar. 1909..	5,079,287	3,279,531	Exp. 1,799,756
" 1908..	4,329,369	3,757,027	" 572,342
Year 1909..	14,473,930	10,453,218	" 4,020,712
" 1908..	12,586,287	10,830,656	" 1,755,631

Exports from the port of New York, week ended May 8: Gold, $1,177,303, chiefly to Paris; silver, $1,065,326, chiefly to London. Imports: Gold, $32,226; silver, $39,647, both from the West Indies and South America.

Gold—There has been less competition for the metal in the open market in London and prices are slightly lower, 77s. 9⅜d. per oz. being paid for bar gold. Paris is still taking a little and the Bank of Germany has also been in the market. Some small shipments of gold have been made from New York to Paris and more is expected to go.

Platinum—The market is quiet, sales being regular but not larger than for some time. The quotations made by dealers in New York are still unchanged, at $23@24 per oz. for refined platinum, $26 for hard metal and $19@21 for scrap.

Our special correspondent reports from St. Petersburg under date of April 29, that the market is dull and inactive. The small dealers and miners still hold some platinum, which is keeping down prices. These small miners are offering crude platinum, 83 per cent. metal, in Ekaterinburg at 4.50 rubles per zolotnik—equal to $16.92 per oz. In St. Petersburg quotations are nominal in the absence of business at 18,000@19,000 rubles per pood—average $18.13 per oz. The conference on the platinum industries under the direction of the Imperial Council has begun its sessions.

Silver—Owing to resales on China account, silver has not maintained the high figure of 24s. 8d. reached in London May 5; but no great decline is looked for.

SILVER AND STERLING EXCHANGE

May.	6	7	8	10	11	12
New York....	53½	53⅛	53⅛	53	53⅛	52⅞
London.....	24⅝	24⅝	24 7/16	24⅜	24 7/16	24 3/16
Sterling Ex..	4.8750	4.8755	4.8755	4.8755	4.8770	4.8775

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to April 29:

	1908.	1909.	Changes.
India.....	£ 2,536,438	£1,471,800	D. £1,064,638
China.....	511,400	1,038,200	I. 526,800
Straits.....	90,200	82,800	D. 7,400
Total.....	£ 3,138,038	£2,592,800	D. £ 545,238

Imports for the week, £2500 from Mexico and £180,000 from New York; total, £182,500. Exports, £67,500 to India and £55,000 to China; £122,500 in all.

Copper, Tin, Lead and Zinc

May.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
6	13 @13¼	12⅝ @12¾	58⅞	29½	4.20 @4.25	4.12½ @4.17½	4.87½ @4.92½
7	13 @13¼	12⅝ @12¾	59¼	29⅝	4.25 @4.27½	4.15 @4.20	4.87½ @4.92½
8	13 @13¼	12⅝ @12⅝	....	29⅝	4.25 @4.27½	4.15 @4.20	4.87½ @4.92½
10	13⅛ @13⅜	12¾ @13	59½	29¾	4.25 @4.30	4.17½ @4.20	4.87½ @4.92½
11	13⅛ @13⅜	12⅞ @13	59⅛	29½	4.25 @4.30	4.17½ @4.22½	4.87½ @4.92½
12	13⅛ @13⅜	12⅞ @13	59 1/16	29½	4.30	4.17½ @4.22½	4.87½ @4.92½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The improvement reported in our last issue made further progress during the week May 6-12. Large orders were placed by domestic and foreign buyers from day to day, the aggregate of the sales running to many millions of pounds. Under this influence prices gradually advanced and close firm at 13⅛@13⅜c. for Lake copper and 12⅞@13c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper was 12⅝@12¾c., the closing price being 12¾@12⅞ cents.

Copper sheets are 16½c. base for large lots. Full extras are charged, and higher prices—up to 18c.—for smaller quantities. Copper wire has been advanced ¼c. to 14½c. base, carload lots at mill. Business has been quite active.

The figures of the Copper Producers' Association for April will be found on an editorial page.

A great deal of speculation concentrated upon the London standard market, and prices advanced from day to day, three months' option several times crossing £60. At the close the tone is somewhat easier at £59 1s. 3d. for spot, £59 15s. for three months.

Refined and manufactured sorts we quote: English tough, £63 10s.; best selected, £62 10s.@£63 10s.; strong sheets, £74 10s.@£76 10s.

Copper exports from the United States for the three months ended March 31 are reported by the Bureau of Statistics at 59,982 tons. For April exports are estimated at 21,235 tons, making 81,217 long tons for the four months.

Tin—In sympathy with copper, tin has advanced in the London market, and while not fully maintaining its gain, closes steady at £132 15s. for spot, £133 15s. for three months.

A fair business was transacted in the domestic market, where consumers have of late shown somewhat more interest. Consumption of the metal seems to be very satisfactory. At the close tin can be bought at about 29½ cents.

Visible stocks of tin on May 1—including 6942 tons afloat—were: Great Britain, 12,122; Holland, 1387; United States, excluding Pacific ports, 5316; total, 18,825 long tons, a decrease of 383 tons during April.

Exports of tin from the Straits in April were 4904 long tons. For the four months ended April 30, the exports were 18,580 tons in 1908, and 18,050 in 1909; decrease, 530 tons.

Spelter—There has been no change either in the volume of business or in the level of prices, and the market closes the same as last week at 4.87½@4.92½ St. Louis, 5.02½@5.07½c. New York.

The John Wahl Commission Company reports to us from St. Louis, under date of May 12, that spelter is strong, but very quiet. Sales are at 4.92½c. for prompt metal, 4.95c. for June.

New York quotations for spelter May 6-12, inclusive, were 5.02½@5.07½ cents.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

The market in London is unchanged at £21 17s. 6d. for good ordinaries, £22 2s. 6d. for specials.

Lead—Consumption has been broadening from day to day and heavy orders have been placed from all sources. Under their influence, together with that of the strikes in Missouri and Utah, prices advanced steadily. The American Smelting and Refining Company raised its price to 4.25c. on May 7, and to 4.30c. on May 12. The market closes firm at 4.17½@4.22½c. St. Louis, and 4.30c. New York.

The John Wahl Commission Company reports to us from St. Louis, under date of May 12, that lead is strong and higher. Latest sales are on a basis of 4.25c. for Missouri brands, and even at that price there are more buyers than sellers. Forward metal cannot be bought below 4.30c. today.

The London market shows only narrow fluctuations and closes steady at £13 5s. for Spanish lead, £13 7s. 6d. for English.

The International Lead Company has been organized at Bayonne, N. J., to manufacture white lead under patents owned by John W. Bailey. The company, which was incorporated at Trenton May 11, with a capital of $1,500,000 will operate a factory at Bayonne for the manufacture of

white lead and kindred products. The incorporators are John W. Bailey, the patentee; John Josten and Harry G. Robinson, of the Newhouse staff. It is stated that the enterprise has no connection with the Newhouse mining properties, and will buy its raw material on the open market.

Other Metals

Antimony—Quotations are 8¼@8½c. for Cookson's; 7¾@8c. for U. S.; 7¼@7½c. for outside brands. Prices are still supported by the expected duty on the metal. Business is lighter than at last report.

Aluminum—Business is quiet and prices unchanged. No. 1 ingots, 22@24c. per lb. base for large lots; wire, 31@32c., and sheets, 33@34c. base.

Quicksilver—Sales are about as usual, and price unchanged. New York, $44.50 per flask of 75 lb.; San Francisco, $44 for domestic and $42 for export trade. London, £8 7s. 6d. per flask, with £8 3s. 9d. quoted from second hands.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Zinc and Lead Ore Markets

Platteville, Wis., May 8—The highest price paid this week for zinc ore was $42 per ton; the base price was $40 per ton of 60-per cent. zinc. For 80-per cent. lead ore, $53 per ton was paid.

SHIPMENTS, WEEK ENDED MAY 8.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	567,760	.....	81,700
Linden	479,470	.....	.....
Benton	343,850	.....	.....
Hazel Green	302,800	.....	.....
Highland	196,700	.....	.....
Strawbridge	176,000	.....	.....
Days Siding	176,000	.....	.....
Cuba City	170,310	50,500	.....
Livingston	160,000	.....	.....
Galena	88,000	.....	.....
Harker	44,040	.....	.....
Total	2,704,930	50,500	81,700
Year to May 8	36,326,494	1,264,060	2,964,800

In addition to the above there was shipped to the American Zinc Ore Separating Company, 668,750 lb., and to the Joplin Separator Works, 60,000 lb. zinc concentrates.

Joplin, May 8—The highest price reported paid for zinc ore was $43 per ton. The high base declined to $40, ranging down to $37, a decline on all grades of $1 per ton for sulphide ores. Silicate ores remained on a base of $17@19 per ton of 40-per cent. zinc, with the high price at $22. Average all grades, $36.96. A little lead sold as high as $57, but the high price generally was $55.50. The average for all grades was $55.26 per ton. A decreased shipment of sulphide ores, with the usual shipment of silicate ore run the average price, all grades, down $1.70 per ton lower than last week.

The shipment is a decrease of 1024 tons of zinc and 34 tons of lead, compared with the previous week. With the shipment lowered to 5131 tons and an output of approximately 5700 tons, there is added to the reserve stock a little over 500 tons. Week-end buying was even lighter than early in the week, with a weaker tendency apparent.

SHIPMENTS, WEEK ENDED MAY 8.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,909,030	800,670	$ 96,689
Joplin	1,439,140	265,000	35,286
Galena	813,830	99,910	16,658
Alba-Neck	582,510	.....	11,650
Duenweg	407,890	147,670	11,361
Aurora	482,520	.....	8,654
Badger	399,520	.....	7,990
Granby	550,780	29,550	7,600
Oronogo	229,460	119,710	7,538
Miami	230,480	96,780	6,510
Spurgeon	229,900	71,710	5,607
Carthage	278,840	.....	5,576
Prosperity	199,090	29,530	4,607
Zincite-Sherwood	201,870	.....	3,835
Cave Springs	142,390	3,050	2,932
Sarcoxie	123,590	.....	2,347
Stott City	41,020	.....	779
Totals	10,261,860	1,663,580	$235,619
19 weeks	213,989,210	34,794,510	$4,775,277

Zinc value, the week, $189,653; 19 weeks, $3,863,212
Lead value, the week, 45,966; 19 weeks, 1,012,06

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	38.63	34.08	37.01	52.47	55.63
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Petroleum

Another cut of 5c. per bbl. in all grades of crude oil was announced in Pittsburg, May 11, by the Standard Oil Company. This makes the second reduction in the price within a week, prior to which time there had been no change in the price in more than two years. Pennsylvania oil is now quoted at $1.68. Large stocks in storage in Oklahoma and a decline in demand caused the cut.

Chemicals

New York, March 12—The market is about the same as last week. Current business is fair, and deliveries on contracts about the same.

Copper Sulphate—Sales continue only fair. The cutting in prices, which was done recently, has been recognized by a decline. Current quotations are $4.22½ per 100 lb. for carload lots and $4.47½ per 100 lb. for smaller orders.

Arsenic—Current quotations are 2⅞@3c. per lb. for white arsenic.

Nitrate of Soda—The market has been quite active, and a fair business was done at ruling prices, which are 2.15c. for spot and 2.12½c. for futures.

Phosphates—Exports of Florida phosphates through the port of Savannah in March are reported by J. M. Lang & Co. at 550 tons, to Germany.

Mining Stocks

New York, May 12—The general stock market during the past week has been active and strong. Speculation for the rise followed closely after the commodities clause decision rendered by the Supreme Court, and interpreted favorably by the large financial interests. The plain evidences of improving business have increased the courage of those favoring a rise in stock values. The improved outlook for copper metal has also been an important factor in aiding the rise in copper stocks. It is, of course, not necessary or certain that a bull movement in the stock market should always terminate in excited trading and million-share days; however, important rises in stock values do often culminate in this way. Careful observers of market conditions are at present cautious in commitments, believing that the present average range of prices is at a point where bad news will have a decided effect. The technical market situation is still strong, notwithstanding the gradual advance for many days past.

The Curb followed the general market, being especially inclined to boom copper stocks.

One sale of Homestake, of South Dakota, was reported during the week, $93 per share being paid for 200 shares.

Boston, May 11—A much better feeling is manifest in the mining-share market and there is hope of its continuance. If it were not for the gyrations of North Butte, prices might be higher. As it is they show substantial advances from a week ago. An improvement is noted in the metal market. Money continues easy and brokers report that they are carrying a comparatively small amount of stocks for customers. Speculative temper is now optimistic and the public, with proper coaching, can be induced to come into the market. Manipulative tactics are now occurring in some specialties with a view of marking prices up.

North Butte has had an extreme fluctuation of almost $6 during the week, breaking from $68.50 to $62.75 with subsequent recovery to $64.75 and the close tonight $62.75. Apparently the same tactics as occurred in Boston & Montana and Butte & Boston, just previous to their being taken into the Amalgamated camp some years ago, are being pursued at the present time. Boston Consolidated enjoyed a spurt from $12.50 to $17.25 last week although it has since reacted to $15.12½. There has been a good demand for Lake and North Lake.

Lake Copper will probably issue 10,000 shares of treasury stock at $25 per share soon to provide working capital.

Shannon Copper sold up $1.50 to $16.75. This company is to issue $600,000 in 6-per cent. convertible bonds for the construction of a railroad to connect the mines with its smelter. They will be convertible into stock at $20 per share within three years. This will require an additional 30,000 shares of stock. The right to subscribe is a $1000 bond for every 500 shares of stock. There is an underwriting commission of 5 per cent. The Copper Range report shows $3.29 earned on the stock, against $4 paid for 1908. Amalgamated had a $6 rise to $84.50 and closed but $1 less.

Giroux Consolidated has been taken from the Curb to the unlisted department of the Stock Exchange. All the better class of stocks on the Curb are higher with an increasing volume of business.

STOCK QUOTATIONS

NEW YORK	May 12	BOSTON	May 12
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	.43	Adventure	9
Amalgamated	83⅛	Allouez	41
Anaconda	51	Am. Zinc	25¾
Balaklala	†2 1/16	Arcadian	5¾
British Col. Cop.	7	Arizona Com	45⅛
Buffalo Mines	3½	Atlantic	10¾
Butte Coalition	26⅜	Boston Con	15⅛
Colonial Silver	¼	Calumet & Ariz	104¼
Cum. Ely Mining	8½	Calumet & Hecla	650
Davis-Daly	6¾	Centennial	†30½
Dominion Cop	12½	Copper Range	80
Douglas Copper	2⅝	Daly-West	10
El Rayo	2¾	East Butte	14
Florence	8 1/16	Franklin	15⅛
Foster Cobalt	.32	Greene—Can	11
Furnace Creek	.11	Hancock	†10¼
Giroux	8¼	Isle Royal	27½
Gold Hill	⅛	Keweenaw	2⅞
Goldfield Con	8	La Salle	14½
Granby	103½	Mass	14⅝
Greene Gold	¼	Michigan	12½
Greene G. & S.	6	Mohawk	65
Guanajuato	1⅝	Nevada	21⅝
Guggen. Exp	190	North Butte	63
Hanapah	15	Ojibway	11⅞
Kerr Lake	8⅛	Old Colony	‡.60
McKinley Dar	.90	Old Dominion	55
Miami Copper	15½	Osceola	133
Micmac	⅝	Parrot	34
Mines Co. of Am.	9 16	Quincy	93
Mitchell Mining	‡⅛	Rhode Island	‡4¾
Mont. Sho. C.	‡11 3/8	Shannon	15¾
Nev. Utah M. & S.	2¾	Superior	41¾
Newhouse M. & S.	3	Superior & Bost.	14⅞
Nipissing Mines	10½	Superior & Pitts.	15
Old Hundred	‡⅛	Tamarack	‡73
Silver Queen	.40	Trinity	14⅝
Stewart	1 16	U. S. Smg. & Ref.	45¾
Tennessee Cop'r.	43¾	U.S. Sm. & Re., pd.	46¾
Tri-Bullion	1 16	Utah Con	42
Union Copper	1⅛	Victoria	5¼
Utah Apex	6½	Winona	6
Utah Copper	52	Wolverine	148
Yukon Gold	4 7/16	Wyandotte	2¾

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	40
Am. Smelt. & Ref.	94¼
Am.Sm. & Ref., pf.	109⅞
Colo. Fuel & Iron	40
Federal M. & S., pf.	91½
National Lead	88
National Lead, pf.	‡107
Pittsburg Coal	‡12
Republic I. & S.	26⅝
Republic I. & S., pf.	86
Sloss-Sheffield	80⅞
Standard Oil	675
U. S. Steel	57⅜
U. S. Steel, pf.	119¼
Va. Car. Chem.	51

BOSTON CURB	Low.
Ahmeek	‡155
Black Mt.	1
Chemung	‡16
Globe Con	6
Helvetia	3⅜
North Lake	‡7⅛
Ray Central	3¾
Ray Con	15⅝
San Antonio	12½

ST. LOUIS	May 8	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.09	.06
Center Cr'k	2.00	1.50
Cent. C. & C.	81.00	79.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	115.00	100.00
Columbia	9.00	6.00
Con. Coal	20.00	19.00
Doe Run	115.00	100.00
Gra. Bimet.	.30	.20
St. Joe	12.50	11.00

LONDON	May 12
Name of Com.	Clg.
Dolores	£1 5s 0d
Stratton's Ind.	0 3 1½
Camp Bird	1 2 6
Esperanza	2 15 0
Tomboy	1 1 3
El Oro	1 7 3
Oroville	0 11 0

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. May 12.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.18
Belcher	.48	St. Ives	.11
Best & Belcher	.37	Triangle	.02
Caledonia	.14	BULLFROG STOCKS	
Challar	.06	Gibraltar	.04½
Comstock	.29	Homestake King.	.01
Con. Cal. & Va.	.66	Mont. Shoshone C.	1.75
Crown Point	.44	Tramp Cons	.06
Exchequer	.27	MISCELLANEOUS	
Gould & Curry	.09	Bonnie Clare	...
Hale & Norcross	.18	Lee Gold Grotto	...
Mexican	.76	Nevada Hills	1.37½
Ophir	1.30	Nevada Smelting.	.87½
Overman	.12	Nevada Wonder	.60
Potosi	.16	Nevada-Utah	2.81¼
Savage	.19	Penn-Wyoming	.02
Sierra Nevada	.26	Pittsburgh S. Pk.	.51
Union	.32	Rawhide Caol't'n.	...
Utah	.04	Round Mt. Sphinx	.13
Yellow Jacket	.64		
TONOPAH STOCKS			
Belmont	.93		
Extension	.65		
Golden Anchor	...		
Jim Butler	.17		
MacNamara	.25		
Midway	.22		
Montana	.80		
North Star	.03		
Tono'h Mine of N.	7.00		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.02		
Atlanta	.16		
Blue Bell	.04½		
Booth	.18		
Columbia Mt.	.12		
Comb. Frac.	.91		
Con. Red Top	.06		
Cracker Jack	.04		
Dia'dfield B. B. C.	.06		
Goldfield Belmont	.04		
Goldfield Daisy	.35½		
Great Bend	.15		
Jumbo Extension	.15		
Kendall	.06		
Lone Star	.06		
May Queen	.04		
Oro	09		
Red Hill	.10		
Roanoke	...		
Sandstorm	.13		

COLO. SPRINGS	May 7
Name of Comp.	Clg.
Acacia	‡.06⅜
Black Bell	....
C. C. Con	‡.03
Dante	.06
Doctor	.09
Elkton	.63½
El Paso	.47
Findlay	.14⅝
Gold Dollar	.10
Gold Sovereign	.03
Isabella	.20⅛
Jack Pot	.06⅝
Jennie Sample	.07
Jerry Johnson	.05¾
Mary McKinney	‡.37
Pharmacist	‡.03
Portland	.88
Un. Gold Mines	.06½
Vindicator	.60
Work	.06¼

Assessments

Company.	Delinq.	Sale.	Amt.
Blackjack Con., Utah	Apr. 15	May 7	$0.01
Blue Wing, Ida	May 8	June 5	0.005
Carney Copper, Ida	Mar. 25	May 1	0.003
Confidence, Nev.	May 18	June 8	0.20
Con. Imperial, Nev.	May 26	June 17	0.01
Echo, Ida	May 1	June 1	0.002
Elk M. & M., Ida	Apr. 20	May 20	0.001
Exchequer, Nev.	May 5	May 26	0.05
Hecla M. & M., Utah	May 15	June 14	0.05
Imlay, Nev.	Apr. 6	Apr. 28	0.03
Julia Con., Nev.	May 24	June 17	0.03
Laclede, Ida	Apr. 7	May 1	0.003
Mexican, Nev	Apr. 8	Apr. 29	0.10
Nev. Superior	Apr. 10	May 1	0.07½
N. Y. Bonanza, Utah	Apr. 7	Apr. 28	0.03
Reindeer C. & G., Ida	Apr. 28	May 28	0.005
Savage, Nev.	Apr. 8	May 5	0.10
Sierra Nevada, Nev	May 4	May 25	0.10
Uintah Treas. Hill, Utah	May 20	June 9	0.01
Utah, Nev.	May 6	May 27	0.03
Yerington Gold, Nev.	Apr. 8	May 12	0.005

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	54.505	51.428	25.133	23.708
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.197
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	12.56¼	12.928	12.93¾	58.331	57.363
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.815	.....
April	31.702	29.445	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1908.	1909.	1909.	1908.	
January	3.691	4.175	4.025	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	4.168	4 051	13.469	13.297
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.